# LabIX

## Creating an Internet Exchange in Your Local Hackerspace
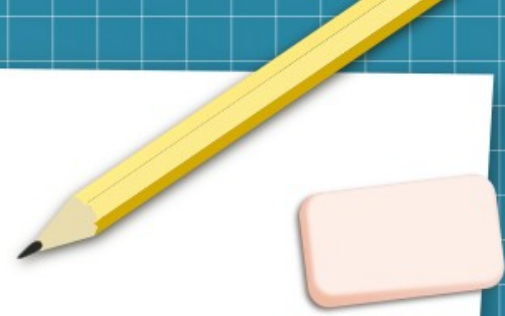
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2023-08-17

Chaos Communication Camp 2023

ix.labitat.dk

# Why am I making this talk?

- Difficult to find information on IXP operation
  - Everything is an acronym soup
- Difficult to understand the administration of IP allocation
  - What policies is needed?

# What is Labitat Internet Exchange (LabIX)?

- A community run internet exchange in Labitat, Copenhagen

- A place to learn network routing, including:

  - BGP

  - Route Server (AS60247)

  - ASN and IP allocation

  - BGP security

    - RPKI, filtering, GTSM

  - 9000 MTU (very soon)

    - Expired RFC draft: Jumbo Frame Deployment at IXPs

# What does your hackerpace need for an IX?

- Friendly uplink connection
    - Peering policies and filters needs to be updated

- Server housing
    - A layer 2 switch
    - Pre-used rack or similar

- At least three peering clients
    - Requirement from RIPE, PeeringDB and IXPDB

- Interested parties
    - Hackerspace projects tend to die over time
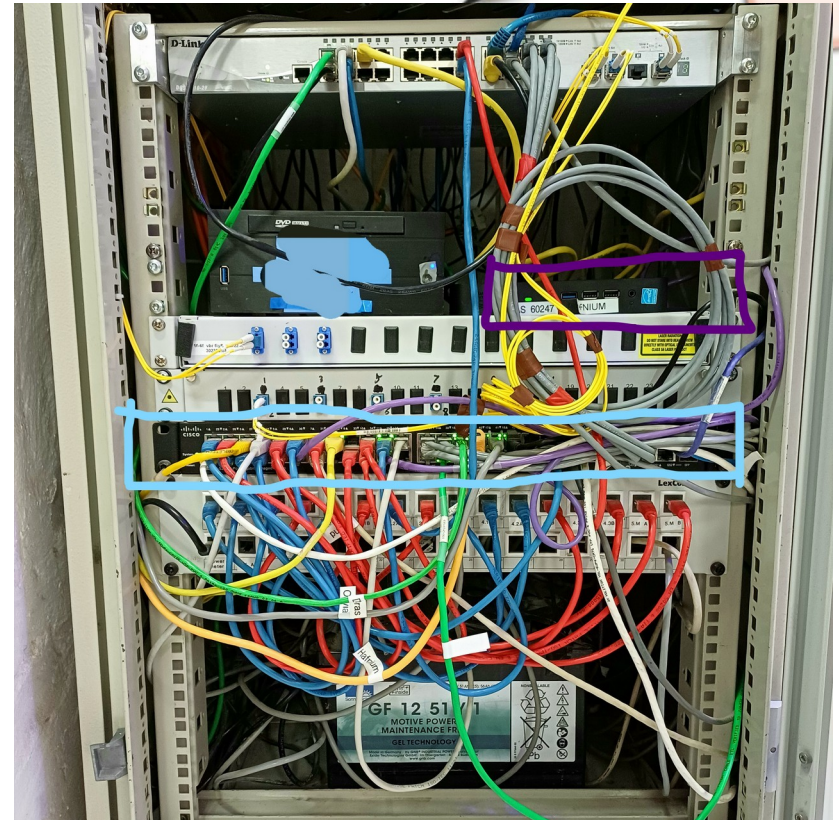
# What is an Internet Exchange?

- Very simpified:
  - A VLAN on a layer 2 switch, with a bunch of connected network operators

- Its more than that, so lets first explain the internet

# How do you do internet routing?

1) Get IP prefixes allocated to you

2) Find hosting facility

3) Install machine

4) Setup an eBGP routing daemon

5) Find peers and peer with them

6) Find a transit uplink for connecting to everyone else

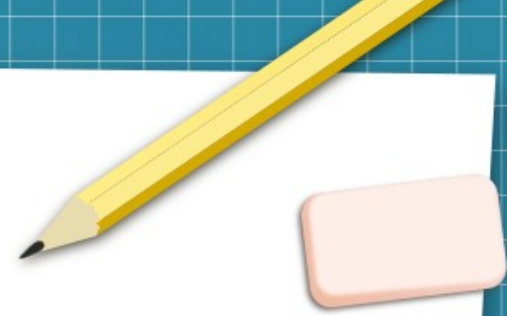7) Profit?

# Let us set a senario
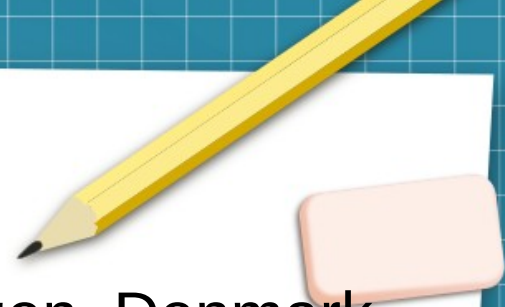
- You are a (eyeball) network provider in Copenhagen, Denmark
  - Meaning: Customers consuming content with their eyeballs
- You need to get content from content providers
- You need IP addresses for your customers and servers
- You need server housing and physical connections (fiber).

# Networks connect to networks



Image source: Catchpoint
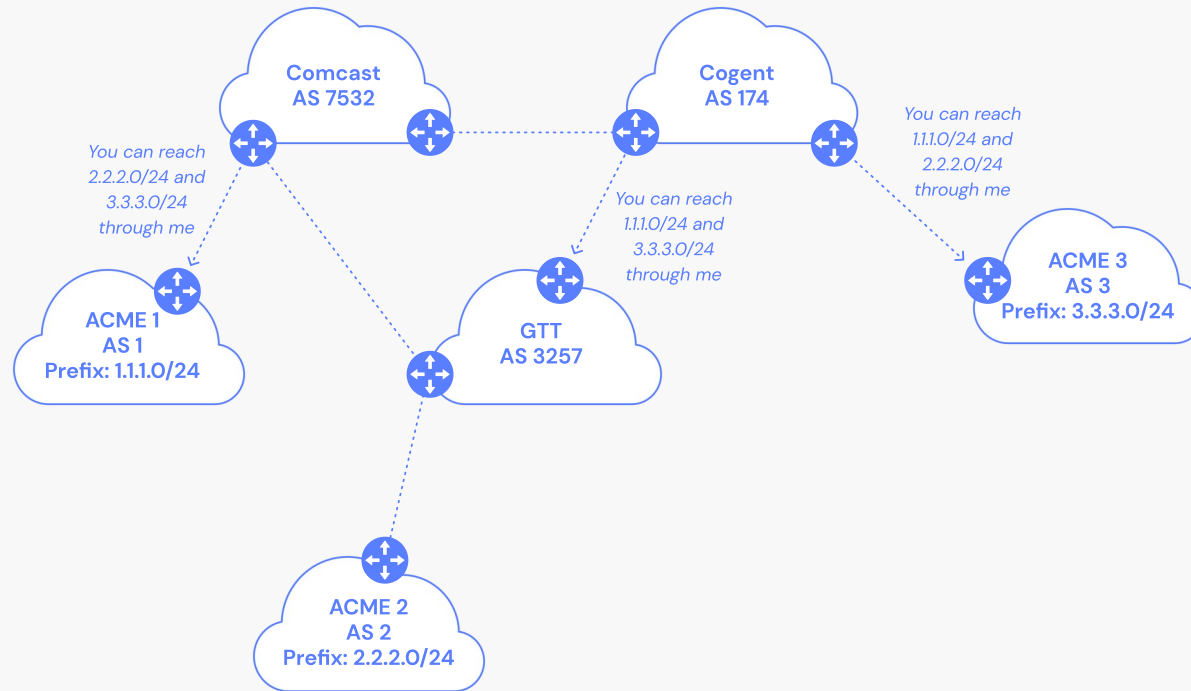
# Autonomous System

- RFC 1930 describes an AS as
  - "a connected group of one or more IP prefixes run by one or more network operators which has a SINGLE and CLEARLY DEFINED routing policy".

- Each AS is assigned an unique 16- or 32-bit Autonomous System Number (ASN)
  - Used to identify organizations and their prefixes

# So what is a routing policy?

- These are called Internet Routing Registry (IRR) objects
    - Found in the RIR databases like RIPE DB

- Example:
    - These IP prefixes should be destined to me
    - AND I accept prefixes destined to- and from my business customers AS 65536 and AS 65537.

Read more:

- RFC 2622: Routing Policy Specification Language (RPSL)
- RIPE NCC. "BGP Security: IRR and Filtering". Feb. 15, 2021

# Peering and transit
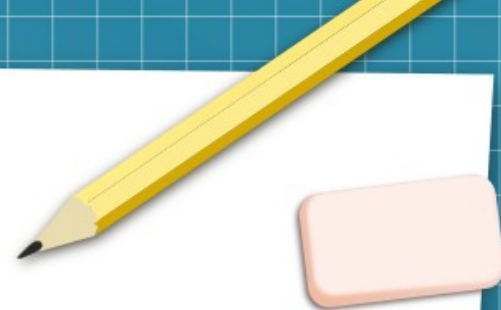
- Peering
  - Free (but includes a setup cost for things like cross-connects and optics)
  - "We only send traffic destined to each other"

- Transit
  - €-cost / Mbit
  - "I will transport traffic from you to other networks"

# The Internet Exchange

- Keep local traffic local
  - Avoid the trambone effect
- Lower latency
- Easier to interconnect with other networks
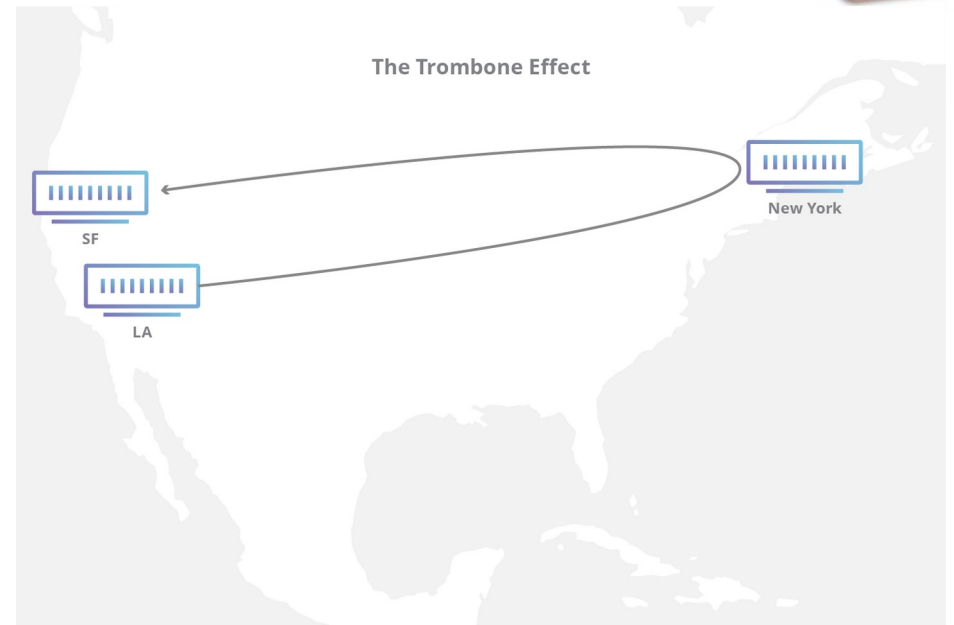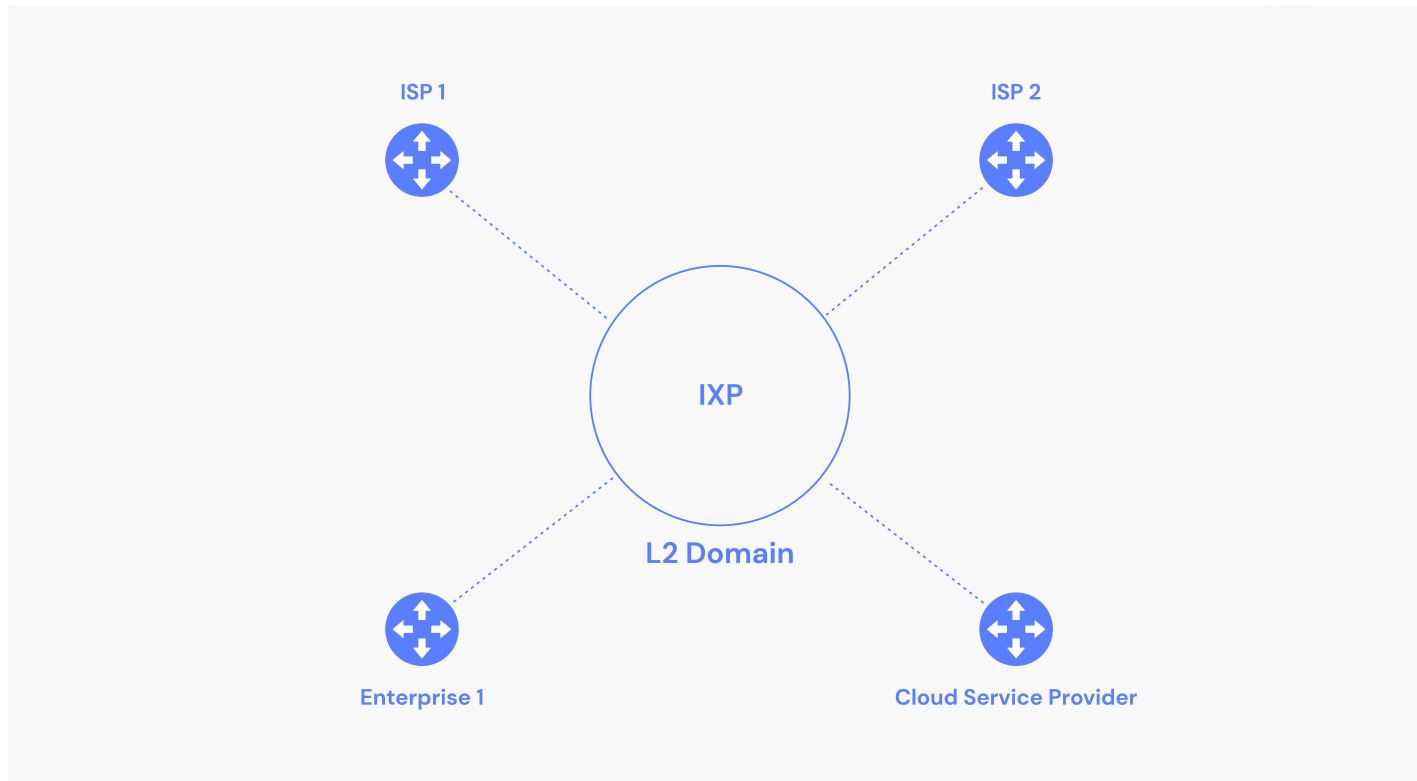  - Recuring cost for data-centre cross-connects

The Trombone Effect

New York

SF

LA

Image source: Cloudflare

# Simplified IXP topology



Image source: Catchpoint

# What is a Route Server?

- Peering interconnections changes
  - From: Many-to-Many
    (Bi-lateral)
  - To: One-to-Many
    (Muli-Lateral)
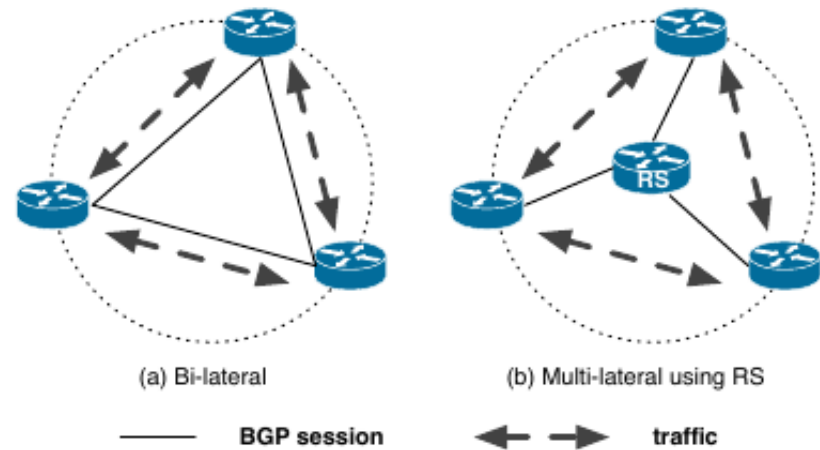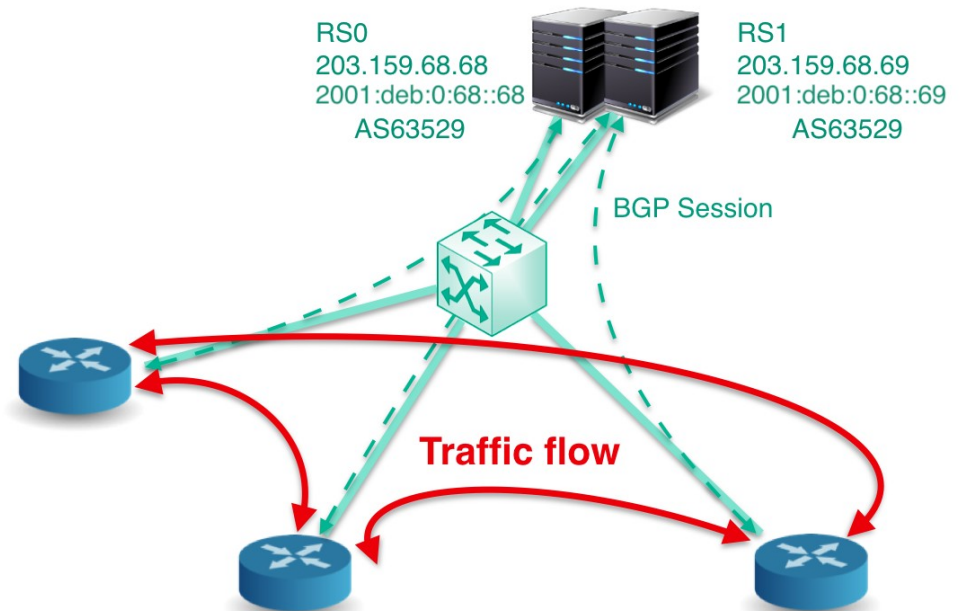- Control-plane traffic is aggregated by the route server



(a) Bi-lateral    (b) Multi-lateral using RS

— BGP session    ← → traffic

**Figure 1: IXP peering options.**

Ricther, et al, 2014

# Advantages of route servers

- Low maintenance aggregation point sessions

- Immediate value for newcomers.

- Debugging tools to have a sense what's going on at the IX



RS0
203.159.68.68
2001:deb:0:68::68
AS63529

RS1
203.159.68.69
2001:deb:0:68::69
AS63529

BGP Session

Traffic flow

Job Snijders, LACNIC29, image by bknix.co.th

# Our route server

- Hardware: Wyse 3030 LT
  - Power usage: 6 Watts
  - Free and available at hand
- Software
  - Debian as operating system
  - Arouteserver as config parser
  - BIRD as BGP speaker

# Server Hosting
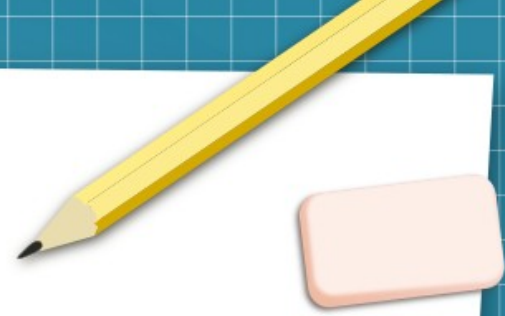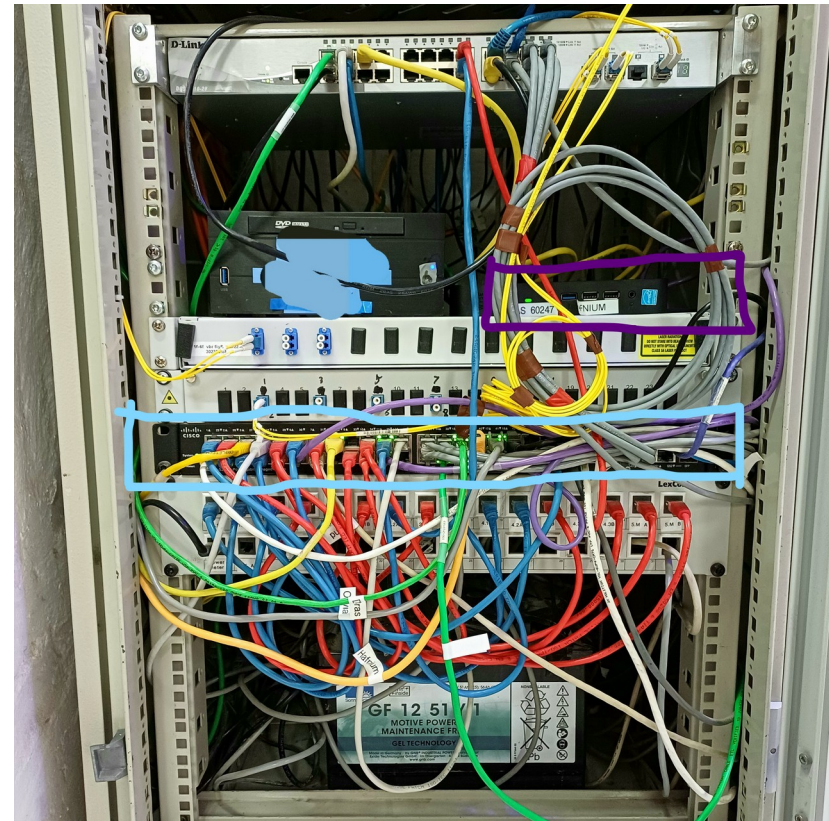
- Machine can be colocated in LabiColo, in Labitat

  - Internal wikipage (PeeringDB facility)

- Intented for small embedded devices such as Raspberry Pi and APU2 (EOL)

Short server housing introduction: IBM.com

# Our switch and rack

- Pre-used Cisco SG300
  - Was already in use at Labitat
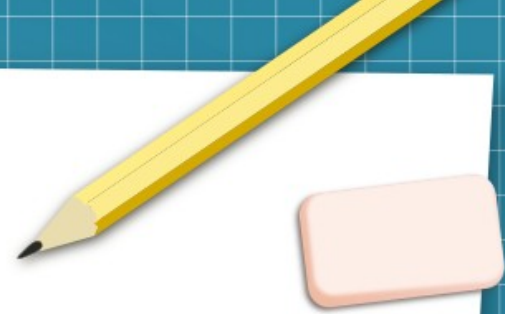  - Can do MAC port filtering

# IX Peering Policy

- Allowed Ethernet frames:
  - 0x0800 - IPv4
  - 0x0806 - ARP
  - 0x86dd - IPv6
- Proxy ARP, OSPF, DHCP, STP/RSTP/VSTP with any kind of CDP/ZEROTIER are not allowed
- MAC-addresses are filtered per port
- Routes learnt through peering network are not allowed to be announced by BGP
- Connecting via any type of tunnel or VPN/Defragmented MTU is prohibited.

Based on LocIX peering policy

# IX Client Peering Policy

- Open
  - "We peer with everyone"
  - Peering with route server, including newcomers

- Selective
  - "We peer with most networks, but contact us first"
  - Direct peering connections

- Restricted
  - "You must meet our conditions before we peer"
  - Ex. transit and large networks

Source: nsrc.org
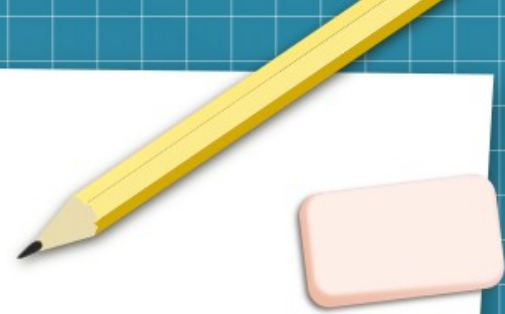
# Getting internet ressources allocated

- IANA -> RIR -> LIR -> End User
  - Network operator: Eyeball and/or business customers, servers and routers
    - Globally routable
  - IXP: For uniquely identify routers of IX members
    - Not globally routed-ish

■ IANA  ■ RIPE  ■ LIR  ■ End User

Illustrative purpose only

# RIPE Database

- Create objects:
  - org: create new, or use existing org
  - mnt
  - person
- Optionally, but required for non-IXPs:
  - AS-Set

Course: RIPE Database from RIPE academy

# Miscellaneous info when talking to LIR

- IX name

- Want route server? YES, then:

  - ASN required

    - Request 16-bit ASN as client can potentially bring old equipment

  - IXP prefix?

    - RIPE has a prefix dedicated for IXPs
      - Specify to only announce withing peering LAN
    - Size: /24 Legacy IP and /48 IPv6

# Miscellaneous info when talking to LIR

- Get hold of a receipt or contract confirming connectivity to IXP colo site

- Have at least three customers that is willing to peer at IXP.

- Facility postal address that is able to receive physical mail

- Contact person name, organisation and phone number

# Finding Local Internet Registry (LIR)

- Ask your local network wizard

- We asked the Freetransit.ch project from Openfactory
  - Bias: We personally know some of the nice people behind it
  - Run by people attending this camp

- Search "RIPE LIR services" in a web search engine
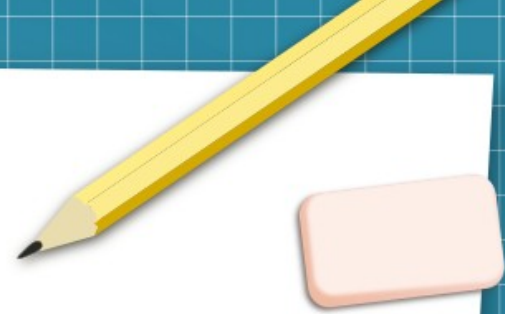
# Similar projects

- The many community run internet exchanges around the globe
- Hosting
  - Coloclue in Amsterdam (PeeringDB)
  - K-space in Tallinn
  - communityrack.org in Zürich (PeeringDB)
- bgp.wtf in Warsaw Hackerspace (PeeringDB)
- Individual Network Berlin (in-berlin.de), in Berlin (PeeringDB)

# Thanks to...
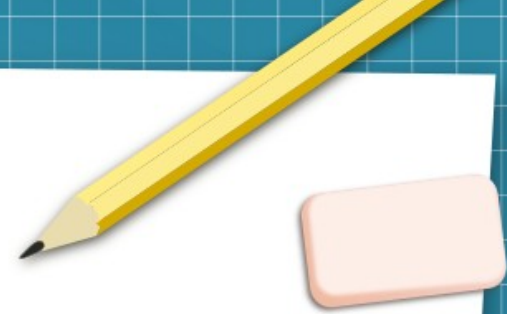
- Project collaborators:
  - Olivia Wenya (AS199750)
  - Daniel Brasholt (AS198886)
- Jori from the Freetransit.ch project for LIR and RIPE matters
- Asbjorn Tønnesen (AS207727) for sharing networking knowledge

# Good ressources

- PeeringDB.com
  - The interconnection database
- BGP.tools
  - Browse the Internet ecosystem
- Local Network Operator Meetups
  - DKNOG in Denmark
  - DENOG in Germany
- RIPE academy. academy.ripe.net
  - Free courses in IPv6, BGP security, RPKI and more
  - Certificate available for a fee

# Good ressources

- Network Startup Research Center. nsrc.org
    - BGP and IXP introduction

- NLNOGs BGP Filter Guide and NLNOG ring
    - BGP filtering and network reachability map

- Euro-IXs Best Current Operational Pratices and the IXP Wishlist
    - Overview of infrastructure considerations for an IX

- Presentation: The 1000$ Internet Exchange at UKNOF32 by Remco van Mook
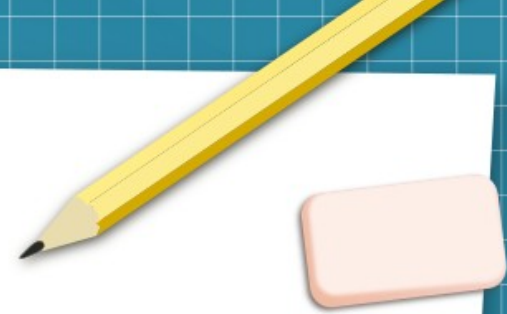
# Find us

- Camps
  - **BGP-enabled hackerspaces meet-up at Chillfloor at 17:00, on day 3**
  - CCCamp at Bornhack village in Cold North cluster
  - BornHack 2024
- Every other day
  - Labitat in Copenhagen

- Website: ix.labitat.dk
- PeeringDB: peeringdb.com/ix/4193
- Plain old email: labix@labitat.dk

# Sponsors?

- All hardware is pre-used

- We are looking for newer hardware, second uplink and stickers!

- LIR fees paid from out of own (student) pocket
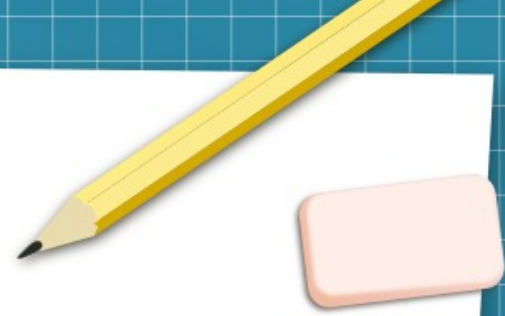
# Whats next?

- Looking Glass for easier debugging

- Limit ARP broadcast storm with ARP Sponge

- Birdwatch: Prometheus Exporter

- Much more documentation

- Setup RPKI relay

  - Labitats uplink already filters for RPKI invalids
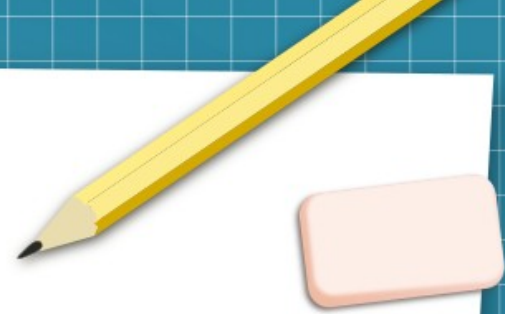
# Thank you for listening

- Download the presentation
    - URL: https://labix-presentation-v2.hafnium.me

2023-08-17