



# Bell's Journey

Network Observability

# A road with obstacles – but nothing is impossible



Internal mindset change



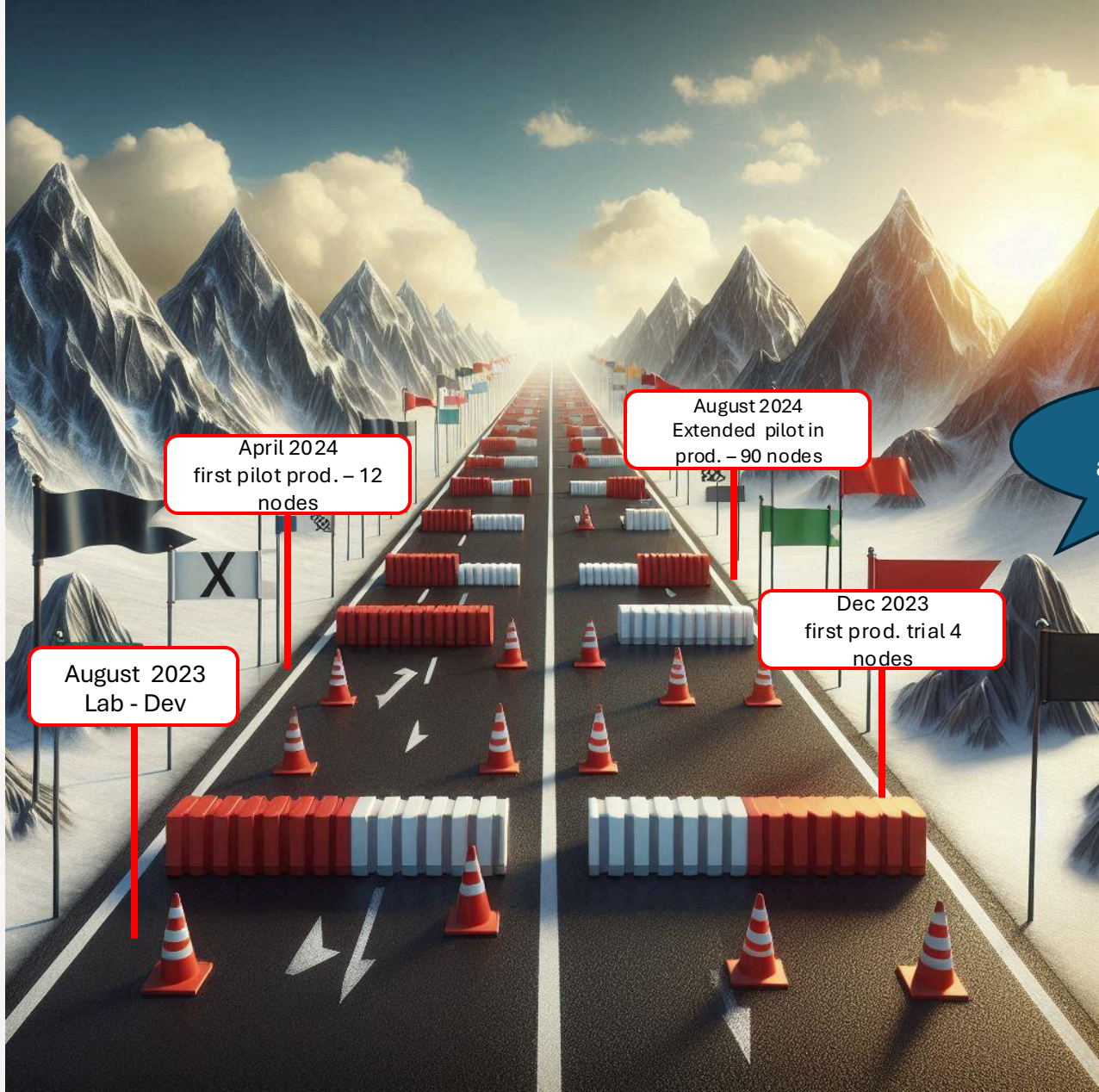
Data collection strategy change – need for centralization view OF data



Multi-vendors chaos with different level of feature maturity



Telemetry and quality of data disperse



April 2024  
first pilot prod. – 12 nodes

August 2024  
Extended pilot in prod. – 90 nodes

August 2023  
Lab - Dev

Dec 2023  
first prod. trial 4 nodes


Few roadkill along the way

# Bell & Swisscom Partnership – Let's work together

**Thomas Graf** · 1st  
Distinguished Network Engineer and Network Analytics...  
7mo · 🌐

Dear colleagues,

It is a great honor and pleasure to announce that Bell Canada and Sw ...see more



7 🎉❤️ 248

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- **Network Telemetry Deployment, Development and Testing**  
Operate and co-develop new open-source Network Telemetry data collection features. Share, use and co-develop open-source Network Telemetry testing framework to validate and improve network vendor Network Telemetry implementations and data collection.
  - **Network Anomaly Detection Deployment, Development and Testing**  
Operate and co-develop open-source Network Anomaly Detection to minimize the MTI (Mean Time to Identify) in network incidents. Share network incident postmortem information's and anonymized labeled operational and analytical network incident data to automate and improve Network Anomaly Detection.
  - **YANG Push Messaging Integration into Apache Kafka Message Broker**  
Automate the integration of new YANG semantics and metrics into Data Mesh. Enable standardized trust boundaries to exchange data across Data Mesh domains.
- These innovations help Bell and Swisscom mutually to gain better visibility into its SRv6 enabled networks, identify and resolve quicker network incidents and automate and integrate the data-processing chain into a Data Mesh architecture. Ultimately ease network maintenance, improve uptime and customer experience.


**Memorandum of Understanding**  
between  
Swisscom (Switzerland) AG  
(hereinafter "Swisscom")  
and  
Bell Canada  
(hereinafter "Bell")  
Jointly defined as "the Parties"

The parties are both engaged at the IETF standardization body to develop and operate next generation Network Analytics capabilities. With this Memorandum of Understanding they want to extend these activities to align onto a common innovation and development roadmap to streamline and align each other's efforts.

Therefore, the Parties defined milestones for the coming two years which is subject to the MoU and that is signed between the Parties on January 30th, 2024.

- 2.1 Network Telemetry Deployment, Development and Testing**
- > **2023/2024 Network Telemetry Deployment**
    - > Swisscom's supports Bell in their Network Telemetry deployment in lab and production by providing information to setup IPFIX, BMP and YANG Push Network Telemetry subscription and data collection.
  - > **07-2024 Network Telemetry Development at IETF 120 hackathon**
    - > Bell enhances IPFIX data collection to support IPFIX Cisco interface and vrf options-templates for new interface and vrf name primitives and their transformation into Apache Avro for publishing to Apache Kafka.
  - > **11-2024 Network Telemetry Test Automation at IETF 121 hackathon**
    - > Swisscom develops a Network Telemetry test automation framework for IPFIX and BMP validation and makes it available open-source at the pmacct github repository.

7 Signatures

|   |   |
|---|---|
| <b>Swisscom (Switzerland) AG</b>  | <b>Bell Canada</b>  |
| <b>Markus Reber</b><br><small>Head of Networks</small><br>05.04.2024 (Qualified Electronic Signature (QES))<br>© 2024 Swisscom (Switzerland) AG | <br><b>Wes Vurma</b><br>VP Core Network and Managed Services |
| Reber Markus<br>Head of Networks  |   |

# One of those Outages

## Critical Outage Impacted Internet and IPTV in Toronto

Prime:  
VP:

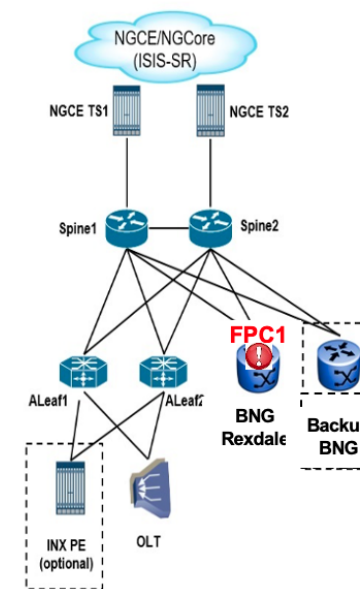
### Outage Description:

- At 9:19 EST on Jan 31, INOC received alarms on a BRAS in Rexdale
- Customers serviced by the BRAS lost their Internet and IPTV services
- Alarms received for the line card servicing the customers
- With the learnings and experience from recent outages on the platform, INOC reloaded the line card as the recovery procedure and restored service by 09:37 EST

### Root Cause:

- 3 outages happened in Jan 2024 on the BNG
- After the Rexdale outage, Vendor identified 2 bugs are related to the recent outages:
  - Linecard bug in Vendor code (fix available in mid-Feb)
  - Subscriber management bug (still under investigation)
- Escalated to Vender executives to confirm root cause and provide fixes

|  |  |
|--|--|
| Condition  |  |
| Severity   | EXTREME  |
| Condition  | LOSS OF SERVICE  |
| Region   | BELL OR  |
| Description  | Potential Outage has been detected with 100/8 customers down in association with CO site TOROON43 with BRAS TOROON4319W, TOROON4319W, TOROON4321W, TOROON4332W |
| Technology   | TECI INNOLOGY  |
| External Reference   | None   |
| <b>Impacts</b>   |  |
| Sites  | TOROON43   |
| Customers Impacted   | 10078  |
| Services   | INTERNET & VIDEO   |
| <b>Date &amp; Time (EST/EDT)</b>   |  |
| Start Date and Time  | 2024-01-31 09:26:36  |
| End Date and Time  | None   |
| Duration   | None   |
| <b>Comments</b>  |  |
| 01/31/2024 10:27: Likely NOT Power Outage Caused - Affected Circuits: 9972, Modems Lost Power Threshold: 5983, Modems Lost Power: 2043 |  |



### Outage details

|                        |                          |
|------------------------|--------------------------|
| Ticket #:              | IN5445557                |
| Date:                  | Date                     |
| Outage start time      | 09:19 EST                |
| Outage detected        | 09:19 EST                |
| Detected by            | Internal "down-detector" |
| Monitoring tools       | Internal "down-detector" |
| Flash / Ignite issued  | 09:54 EST                |
| Exec notif issued      | 10:06 EST                |
| Customer notification? | N/A                      |
| Workaround enabled?    | 09:30 EST                |
| Outage end time        | 09:37 EST                |
| Duration:              | 18 mins                  |

### Customer impacts / Experience

Number of Customers affected per services

### Services / applications impacted

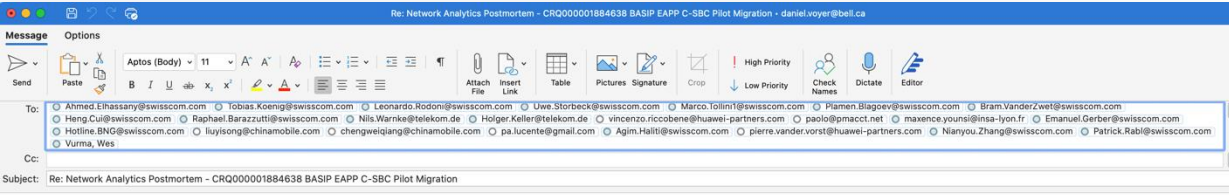
Impact on Services XYZ

### Top Lessons Learned / Next Steps or Focus Areas

| Learning / Focus Area | Action/Next Step   | Primes | Due Date   |
|-----------------------|--|--------|--|
| Root Cause & triggers | <ul style="list-style-type: none"> <li>Work with Vender to understand triggers and root cause</li> </ul>   |        | <ul style="list-style-type: none"> <li>Feb 7</li> </ul>                  |
| Mitigation and Fix    | <ul style="list-style-type: none"> <li>Develop rollout strategy on mitigations once available from Vender to reduce vulnerability</li> <li>Validate fix and develop rollout strategy once available from Vender</li> </ul> |        | <ul style="list-style-type: none"> <li>Feb 9</li> <li>End-Feb</li> </ul> |
| Detection             | <ul style="list-style-type: none"> <li>Vender to provide known signature(s)</li> </ul>   |        |  |
|                       |  |        |  |

# Bell & Swisscom Partnership

## Sharing outages to learn from each others and enhance anomaly detection mechanism



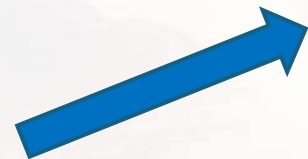
**From:** Thomas.Graf@swisscom.com  
**When:** 7:30 AM - 8:15 AM April 24, 2024  
**Subject:** Network Analytics Postmortem - CRQ000001884638 BASIP EAPP C-SBC Pilot Migration  
**Location:** Microsoft Teams Meeting

Dear colleagues,  
On April 9<sup>th</sup> during a pilot network maintenance window, L3 VPN BGP topology changes were propagated across a multivendor MPLS / MPLS-SR network at Swisscom.

These topology changes were observed through manual CLI show commands and BMP (BGP Route Monitoring) on 8 transit MPLS Inter-AS Option B nodes. L3 VPN BGP topology changes were rolled out in 4 steps. Where in step 3, 2 out of 8 redundant nodes observed the BGP routing topology changes with 20 minutes delay for unknown reasons. Swisscom scheduled two upcoming maintenance windows with production traffic involved requiring that these observations need to be understood in a more deeper level before going ahead.

INSA Lyon and Swisscom's Daisy team are developing Bright Lights Network Anomaly Detection to recognize such incidents faster than humans can.

- In this Network Analytics postmortem we have colleagues from
- INSA University Lyon
  - Huawei Research Center in Dublin
  - Bell Canada , Deutsche Telekom and China Mobile Network Operator
  - Swisscom NRE, OCC, BNG, TIP and IT Clouds



### April 9th, BASIP EAPP C-SBC Pilot Migration CRQ000001884638, Post Maintenance Window Analysis

```
show route table bgp.l3vpn.0 protocol bgp 138.187.57.240/28 detail
60633:4101214024:138.187.57.240/28 (1 entry, 1 announced)
BGP
  Preference: 170/-101
  Route Distinguisher: 60633:4101214024
  Next hop type: Indirect, Next hop index: 0
  Address: 0x1a963a3c
  Next-hop reference count: 8
  Source: 138.190.128.116
  Protocol next hop: 138.187.57.5
  Label operation: Push 83714
  Label TTL action: prop-ttl
  Load balance label: Label 83714; None;
  Indirect next hop: 0x2 no-forward INH Session ID: 0x0
  State: <Delete Int Ext ProtectionPath ProtectionCand>
  Local AS: 64088.1116 Peer AS: 64088.1116
  Age: 5:28 Metric: 805 Metric2: 4
  Validation State: unverified
  Resolving-AIGP: 4
  Effective metric: 8 (IGP metric plus resolving AIGP)
  Task: BGP_64088.1116.138.190.128.116
  Announcement bits (1): 1-BMP
  AS path: 60633 64088.5 ?
  Communities: 60633:204 60633:208 60633:1002 64497:4965
  99:13338 target:60633:1100006314
  Accepted
  BMP: Pre: withdraw Station: DAISY BMP_1
  BMP: Pre: withdraw Station: DAISY BMP_2
  BMP: Station: <unassigned>
  Color: VPN Label: 83714
  Localpref: 100
  Router ID: 138.187.57.3
  Thread: junos-main

show route table bgp.l3vpn.0 protocol bgp 138.187.57.240/28 detail
60633:4103214024:138.187.57.240/28 (3 entries, 1 announced)
*BGP
  Preference: 170/-101
  Route Distinguisher: 60633:4103214024
  Address: 0x1526757c
  Next-hop reference count: 4
  Source: 138.187.57.3
  Protocol next hop: 138.190.128.180
  Label operation: Push 83118
  Label TTL action: prop-ttl
  Load balance label: Label 83118; None;
  Indirect next hop: 0x2 no-forward INH Session ID: 0x0
  State: <Active Ext ProtectionPath ProtectionCand>
  Local AS: 64088.1116 Peer AS: 60633
  Age: 14:29:45 Metric: 800 Metric2: 4
  Validation State: unverified
  Resolving-AIGP: 4
  Effective metric: 8 (IGP metric plus resolving AIGP)
  Task: BGP_60633.138.187.57.3
  Announcement bits (2): 0-BGP_RT_Background 1-BMP
  Communities: 60633:204 60633:208 60633:1001 60633:1111
  64497:4965 64499:13338 target:60633:1100006314
  Accepted
  BMP: Pre: advertise Station: DAISY BMP_1
  BMP: Pre: advertise Station: DAISY BMP_2
  BMP: Station: <unassigned>
  Color: VPN Label: 83118
  Localpref: 100
  Router ID: 138.187.57.3
  Thread: junos-main
```

**sos** Juniper JunOS CLI show command shows that path is for 20min no longer primary active but still as backup path inactive. **Output mislead network engineer to believe that path is still installed.**

Let's review outages to help each others

# Yet Another Outage at Bell (YAOB)

## Scenario for real Outage– IPTV and Mobility Outage

Prime:  
VP:

**Outage Description:**

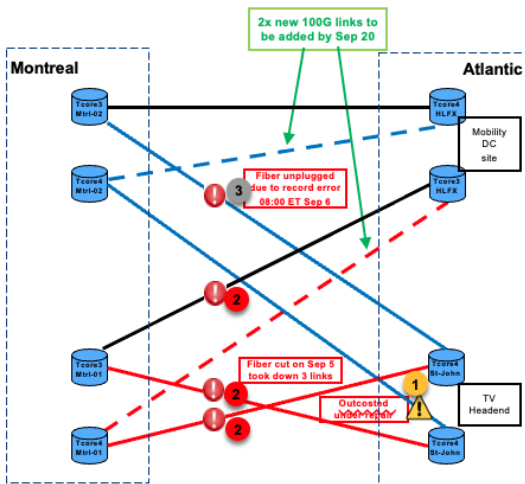
- On April 6<sup>th</sup>, customers in the Region A saw impacts to TV and mobility services caused by multiple network issues happened simultaneously

**Root Cause:**

- 5 of 6 IP Core links were down between City A and region B due to multiple network issues:
  - One link between City A and City B was under repair and out-costed
  - Fiber cut west of City B which impacted 3 links
  - A fiber was disconnected erroneously in a transport facility in City B due to incorrect information in FWO

**Resolution:**

- Describes resolution solutions & steps



**Outage details**

|                        |                          |
|------------------------|--------------------------|
| Ticket #:              | INC480805                |
| Date:                  | April 06                 |
| Outage start time      | 08:00ET                  |
| Outage detected        | 08:04 ET                 |
| Detected by            | Group a and b            |
| Monitoring tools       | Thousand Eyes, New Relic |
| Flash / Ignite issued  | NA                       |
| Exec notif issued      | NA                       |
| Customer notification? | NA                       |
| Workaround enabled?    | 08:30 ET                 |
| Outage end time        | 08:30 ET                 |
| Duration:              | 30 mins                  |

**Customer Impacts / Experience**

Customer impact in number

**Services / applications impacted**

Services

| Learning / Focus Area                                  | Action/Next Step  | Prime | Due Date |
|--|---|-------|----------|
| Repair the fiber cut between City A, City B and City C | <ul style="list-style-type: none"> <li>Temporary repaired 11:30 ET on 6</li> <li>Permanent repair the fiber cut to restore the remaining 3 impacted links in progress</li> </ul>          |       |          |
| Augment capacity between Region A and Region B         | <ul style="list-style-type: none"> <li>Add 2x 100G links between city A and City B to accommodate increasing traffic and provide additional capacity during failover situation</li> </ul> |       |          |
| Lack of warning when capacity at risk                  | <ul style="list-style-type: none"> <li>Process adjustment to alert when capacity going to a node, location and/or region is at risk</li> </ul>  |       |          |

The **bad**: Awareness of the 5 links down but without correlation no visibility on customer impact or network vulnerability

The **objective**: Root causes & awareness needs to be auto-generated with correlations and sent to operations

# Network Telemetry and Data Analytic

## Objectives:

- Provide a centralize view of the End-to-End Network infrastructure and its services
  - To enable Anomaly Detection– real-time, in-depth awareness
  - To enable E2E network visualization
  - To enable network optimization
  - To enable verification, troubleshooting and notification
  - To enable event tracking and prediction
  - To enable policy and intent compliance

**The project aim at centralizing network telemetry data to a data lake, for data analytic and future projects**



**Thank You!**

**What's your  
YAOB ?  
(Yet Another Outage at Bell)**