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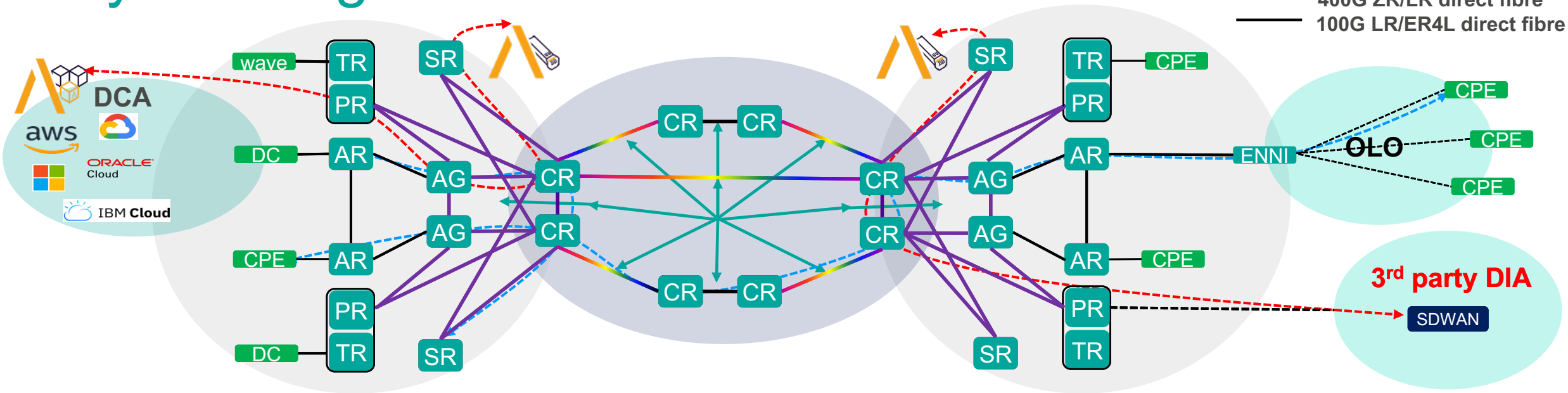
Senior Specialist Packet Architect
Colt Technology Services

Routing Correlated Analytics

MPLS SD&AI NET WORLD
9/11 APRIL 24

Key Building Blocks



Services OAM

Ethernet Y.1731
IP TWAMP lite

External probes

ICMP
TWAMP lite

SR-PM

RON 400G 100%

Silicon Evolution

PR AG SR AR CPE

Network enablement

Skylight Analytics PM/ML

colt On Demand

SRS – GP Apps

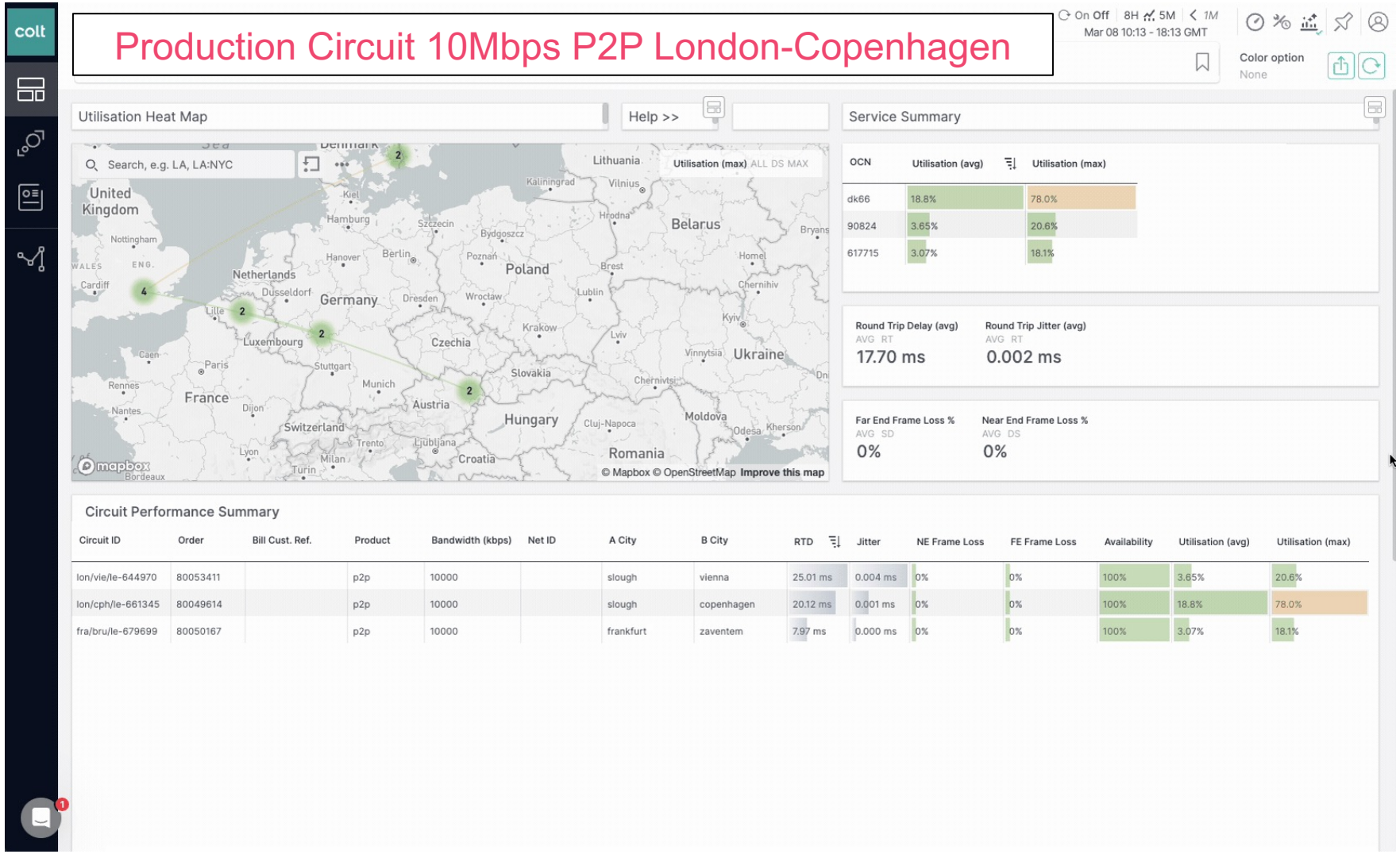
SDN stack

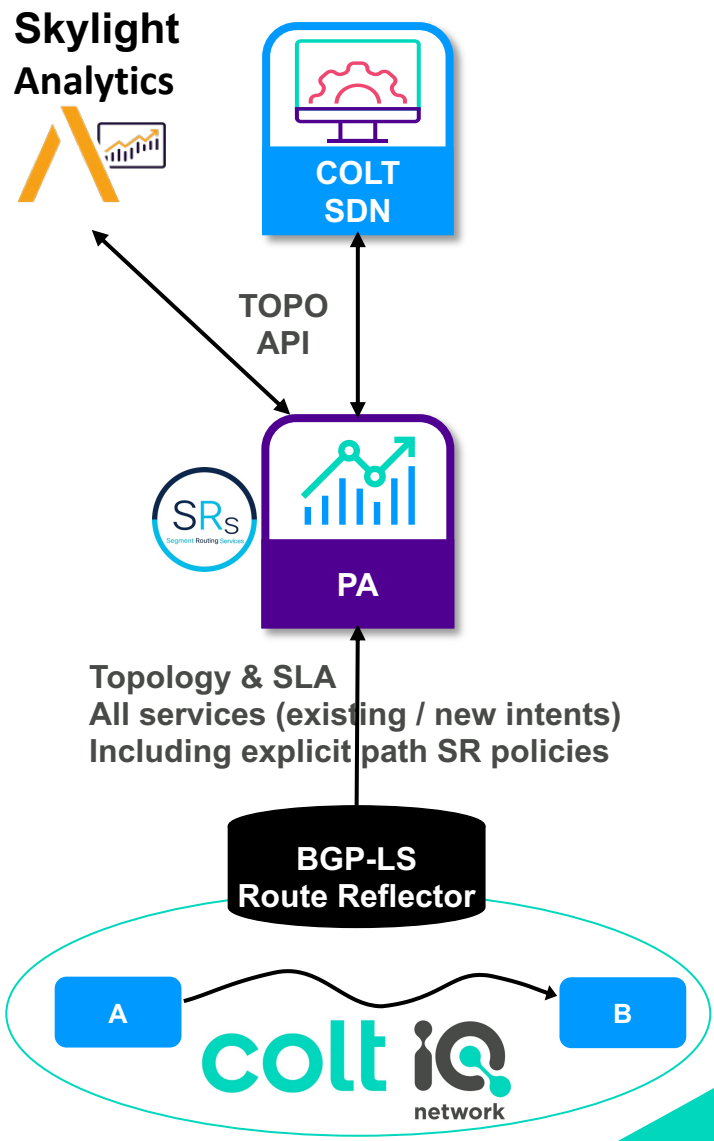
NSO

itential

“Cloud like” service consumption and visualisation

- Colt IQ Network > 2.8k edge/core routers
- Core EU-US-APAC connecting > 1100 DC’s and > 33k buildings (own fiber)





Any service | **Topology + SLA** | **Realtime vs Historical**

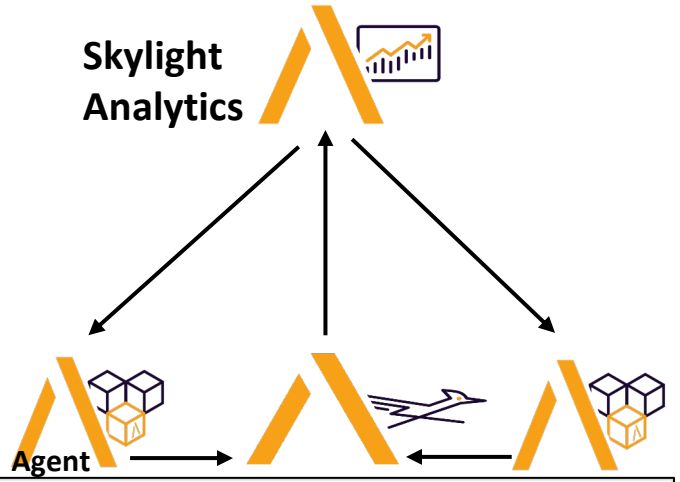
“Cloud like” service power utilisation

London-Copenhagen service path core section details

Device Throughput & Power

Dev Name	Bandwidth	Traffic In	Traffic Out	In Peak	Out Peak	In %	Out %	In % (Peak)	Out % (Peak)	Power (Watts/Tbps)	# of objects
cr1.CPH	1100 Gbps	75.3 Gbps	75.3 Gbps	90.5 Gbps	91.8 Gbps	6.85%	6.85%	8.23%	8.35%	751	25
cr2.HAM	2700 Gbps	177.0 Gbps	176.9 Gbps	217.5 Gbps	216.2 Gbps	6.56%	6.55%	8.05%	8.01%	173	22
cr1.HAM	2600 Gbps	215.7 Gbps	215.6 Gbps	269.9 Gbps	266.8 Gbps	8.29%	8.29%	10.38%	10.26%	169	14
cr2.DUS	2700 Gbps	284.8 Gbps	284.7 Gbps	357.2 Gbps	352.8 Gbps	10.55%	10.55%	13.23%	13.07%	175	25
cr1.AMS	3600 Gbps	163.4 Gbps	163.4 Gbps	243.5 Gbps	235.0 Gbps	4.54%	4.54%	6.77%	6.53%	148	25
cr2.AMS	3500 Gbps	189.2 Gbps	189.2 Gbps	253.6 Gbps	251.0 Gbps	5.41%	5.41%	7.25%	7.17%	151	19
cr1.BRU	3100 Gbps	166.2 Gbps	166.2 Gbps	237.1 Gbps	250.0 Gbps	5.36%	5.36%	7.65%	8.06%	155	25
cr2.BRU	3200 Gbps	178.4 Gbps	178.4 Gbps	256.0 Gbps	263.7 Gbps	5.58%	5.58%	8.00%	8.24%	157	12
cr1.Lon	3900 Gbps	431.6 Gbps	431.6 Gbps	523.3 Gbps	522.2 Gbps	11.07%	11.07%	13.42%	13.39%	65	25

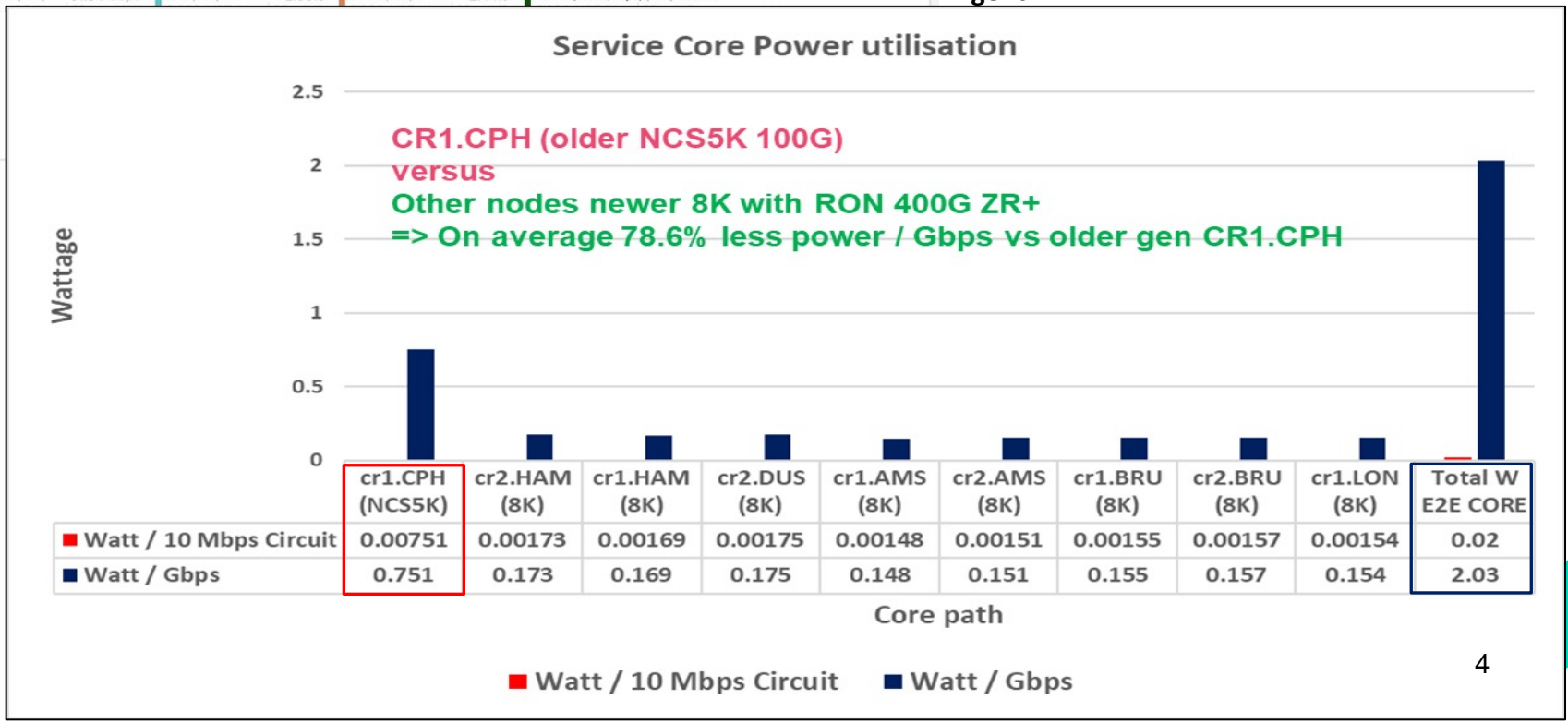
Traffic In [192] 5.3 Gbps | Traffic Out [192] 5.32 Gbps | In Peak [192] 64.5 Gbps | Out Peak [192] 61.84 Gbps | In % [192] 2.53% | Out % [192] 2.44% | Power (Watts/Tbps) [192] 225.8



16.29 Feb 20 2024

A 0.02033w - 9.49 ms - 8 Hops

Watts / Service	Watts / Gps	Delay Min	Node
0.00751	0.751		cr1.CPH (cr1.CPH)
0.00173	0.173	2.10ms	cr2.HAM
0.00169	0.169	1µs	cr1.HAM
0.00175	0.175	2.39ms	cr2.DUS (cr2.DUS)
0.00148	0.148	1.34ms	cr1.AMS (cr1.AMS)
0.00151	0.151	26µs	cr2.AMS (cr2.AMS)
0.00155	0.155	1.42ms	cr1.BRU (cr1.BRU)
0.00157	0.157	90µs	cr2.BRU (cr2.BRU)
0.00157	0.157	2.12ms	cr1.LON (cr1.LON)

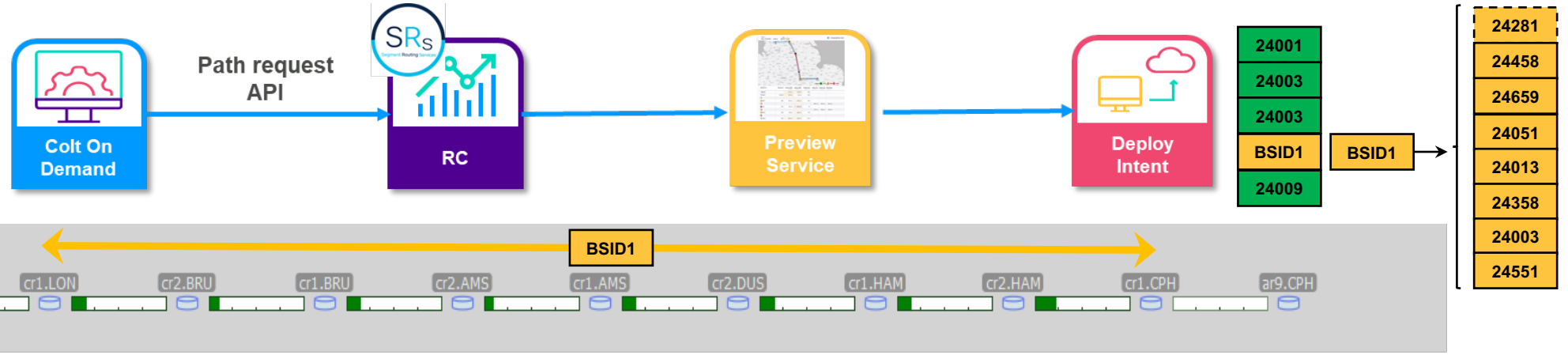


“Cloud Like” deterministic path connectivity

INTENT 10Mbit
LON DC x – CPH DC z

Unprotected P2P

MSD max 9 @ headend




```
~ $ ./te-client --max-segments=9 --unprotected ar161.LON ar9.CPH
Resolving TE Router-ID for headend ar161.LON... 212.74.93.185
Resolving TE Router-ID for tailend ar9.CPH...   212.36.183.202

Requesting path from 212.74.93.185 (ar161.LON) to 212.36.183.202 (ar9.CPH)...

Result:
=======

Path cost: 609720

Segment lists:
1. { 24001, 24003, 24003, BSID(1), 24009 }

Transit paths:
1. Headend: 193.114.172.123
   Tailend: 193.114.172.95
   Binding-SID: 1
   Segment lists: { 24281, 24458, 24659, 24051, 24013, 24358, 24003, 24551 }

Links:
1. ar161.LON - ag7.LON, IGP metric 200000, Delay 25
2. ag7.LON - ag8.LON, IGP metric 20, Delay 8
3. ag8.LON - cr1.LON, IGP metric 200000, Delay 382
4. cr1.LON - cr2.BRU, IGP metric 2100, Delay 2099
5. cr2.BRU - cr1.BRU, IGP metric 100, Delay 90
6. cr1.BRU - cr2.AMS, IGP metric 1400, Delay 1433
7. cr2.AMS - cr1.AMS, IGP metric 100, Delay 26
8. cr1.AMS - cr2.DUS, IGP metric 1400, Delay 1326
9. cr2.DUS - cr1.HAM, IGP metric 2400, Delay 2413
10. cr1.HAM - cr2.HAM, IGP metric 100, Delay 1
11. cr2.HAM - cr1.CPH, IGP metric 2100, Delay 2106
12. cr1.CPH - ar9.CPH, IGP metric 200000, Delay 25
```

https://app.electricitymaps.com/map
Next: derive service Carbon intensity + calculate greener path (new metric)
Per device location using general or own energy supply g CO_2 eq/kWh database

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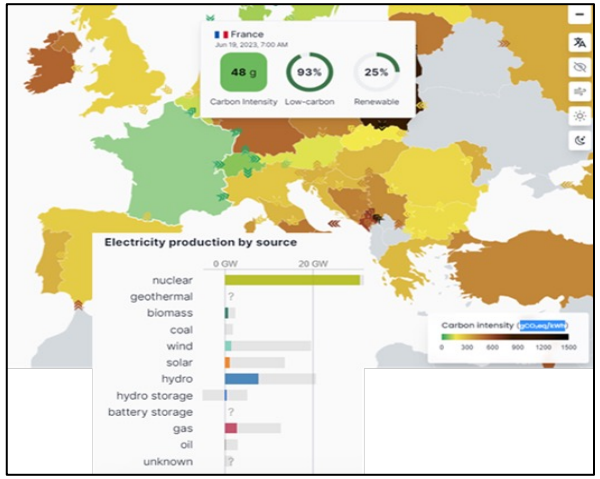

Next stop “ML/AI”

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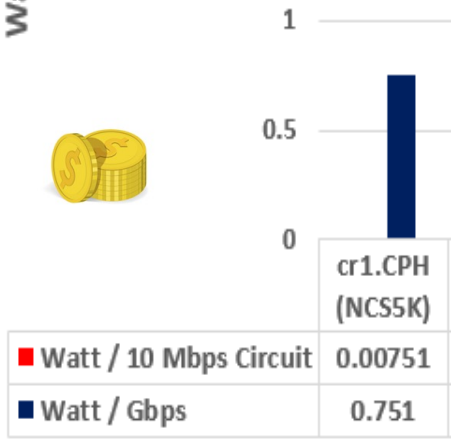
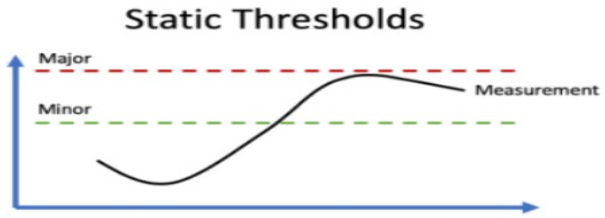
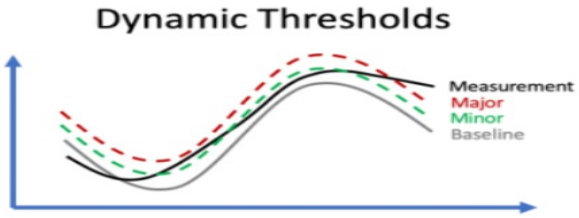


Optimise “sustainability + economics”

- Data insights power/bw consumption, costs, emission, space
  - Per service, device, link, DC, city, …
  - Predict trends (cost, capacity, emission)
- Analyze and propose optimizations
  - Model new silicon and/or transport (RON) swap
    - Device role (function / scale / capacity / features)
      - New “multi role function” silicon helps
      - Investment vs ROI KPI’s (greener, economics)
  - Traffic steering vs intent KPI’s





PoC Example: Machine Learning and AI

Service Change Requested

- Packet Loss Increasing
- Delay Max Increasing
- Delay Min / Average moving towards Delay Max
- Input byte counts increasing
- Inference engine determines and overload condition
- Service moves from **green** to **red**
- Service change sent to the orchestration layer (Colt On Demand) to requested to modify service parameters to alleviate the overload condition

Service Change Not Requested

- Packet Loss Increasing
- Delay Max Stable
- Delay Min / Average stable, not increasing towards max
- Input byte counts stable
- Inference engine determines some anomaly, primarily from packet loss
- Service moves from **green** to **amber**
- Service change not requested as overload condition not detected

On Demand Elastic Service

RCA – Self Healing

- Detect when services are not performing well
  - Dynamic service baselining Skylight PM
  - Analyze service KPI’s
    - delay, jitter, packet loss, bandwidth
- Determine root case + optional mitigation
  - Analyze KPI’s + baseline
    - Network issue => RCA underlay vs overlay
      - Shift traffic towards alternative path
    - Service overload => optional auto upgrade

Thank you

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www.colt.net