



EVALUATING THE IMPACT OF UEFA CHAMPIONS LEAGUE MATCHES ON INTERNET TRAFFIC

***WEDNESDAY INTERNET TRAFFIC DURING UEFA CL MATCHES
(as seen at MINAP and NAMEX)***

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Special Projects
NAQUADRIA | PCIX



Internet Service Provider

Tier III Datacenter
Colocation, Cloud
Managed Services
5 ISO certifications
ACN qualification

www.naquadria.it

Internet Exchange Point

managed by Naquadria

Free membership
Free 1 / 10 / 100 Gbps port
Layer 2 PCIX-VSIX
K-root node
MS Cache, ...

www.pcix.it

Live sport streaming events

→ football live streaming events

→ UEFA Champions League live streaming events

→ UEFA CL Wednesday night live streaming events

Wednesday CL events: streaming only on Amazon Prime Video

UEFA Champions League Wed night matches observed:

- CL 2023–2024 Knockout Phase (Feb–May 2024) (8)
- CL 2024–2025 League Phase (Set 2024 – Jan 2025) (8)
- CL 2024–2025 Knockout Phase (Feb–May 2025)



- **Italian IXPs : MIX, NAMEX, MINAP, TOP-IX, VSIX, ...**
(ordered by traffic / peer #)
- **Traffic data publicly available**
- **Data collected @ MINAP and NAMEX (IXPManager-based)**
(see <https://www.minap.it> and <https://www.namex.it>)
- **Focus on «prime time» (~ 9-11 pm) of Wed nights**
- **Analysis of traffic deviations during Wed UEFA CL matches**

Note: Amazon member @ Namex , not @ MINAP



Where we retrieve traffic data



see <https://www.ixpmanager.org/community/user-list>

IT (MINAP, NAMEX)
IE (INEX)
GB (LONAP, NCL-IX)
SE (STHIX)
DE (BCIX, DO-IX, ...)
NL (DATAIX, FRYS-IX, ...)
RO (InterLAN)
GR (GR-IX)
HR (CIX)
[...]

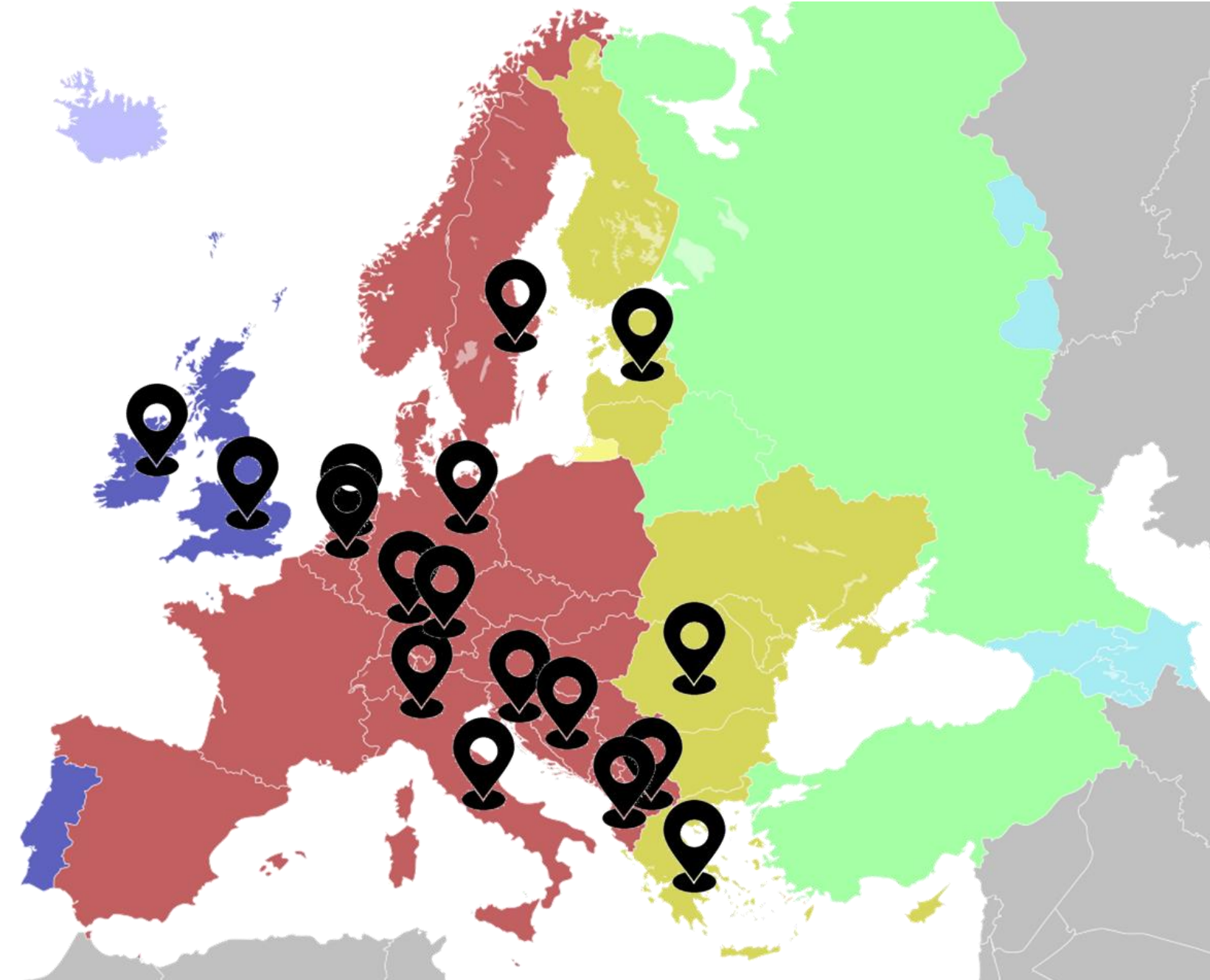


Image source: https://en.wikipedia.org/wiki/Central_European_Time#/media/File:Time_zones_of_the_Greater_Europe.svg



Which traffic data we collect



[https://ixp.example.com/grapher/{graph}\[?id=x\]\[&period=x\]\[&type=x\].....](https://ixp.example.com/grapher/{graph}[?id=x][&period=x][&type=x].....)

API access

current traffic
[bps]



```
{
  "class": "ixp",
  "urls": {
    "png": "https://www.inex.ie/ixp/grapher/ixp?period=day&type=png&category=bits",
    "log": "https://www.inex.ie/ixp/grapher/ixp?period=day&type=log&category=bits",
    "json": "https://www.inex.ie/ixp/grapher/ixp?period=day&type=json&category=bits"
  },
  "base_url": "https://www.inex.ie/ixp/grapher/ixp",
  "statistics": {
    "totalin": 15013439801606864,
    "totalout": 15013959560329200,
    "curin": 158715231920,
    "curout": 158713872624,
    "averagein": 125566129180.59367,
    "averageout": 125570476225.09074,
    "maxin": 222438012592,
    "maxout": 222348641336
  },
  "params": {
    "type": "json",
    "category": "bits",
    "period": "day",
    "protocol": "all",
    "id": 1
  }
}
```

source: <https://docs.ixpmanager.org/grapher/api/>



Which traffic data we collect / 2



ISO 8601 timestamp
Mon to Sun week

10m «sampling»
144 samples / day
1008 samples / week
~ 53k samples / year

```
▼ statistics:  
  totalin:      18553775624851200  
  totalout:     18574859820993600  
  curin:        187859791184  
  curout:       188403157184  
  averagein:    155191755652.0201  
  averageout:   155168340209.32663  
  maxin:        358128403480  
  maxout:       355973849680  
  maxinat:      "2023-09-27T19:50:00.000000Z"  
  maxoutat:     "2023-09-27T19:50:00.000000Z"  
▼ params:  
  type:         "json"  
  category:     "bits"  
  period:       "day"  
  protocol:     "all"  
  id:           1
```

e.g CSV dataset record: **YYYYMMDDThhmmssZ,187859791184,188403157184[,...]**



DATA METRICS & STATISTICS

DIMENSIONAL PARAMETERS (DAILY/WEEKLY):

min | max | 1Q | median | 3Q | 5p | 10p | 90p | 95p
range=(max-min) | AVG | STD DEV | MAD | IQR=(3Q-1Q) | ...

ADIMENSIONAL PARAMETERS (DAILY/WEEKLY):

max/min | max/AVG | CoV | ...

NORMALIZATION:

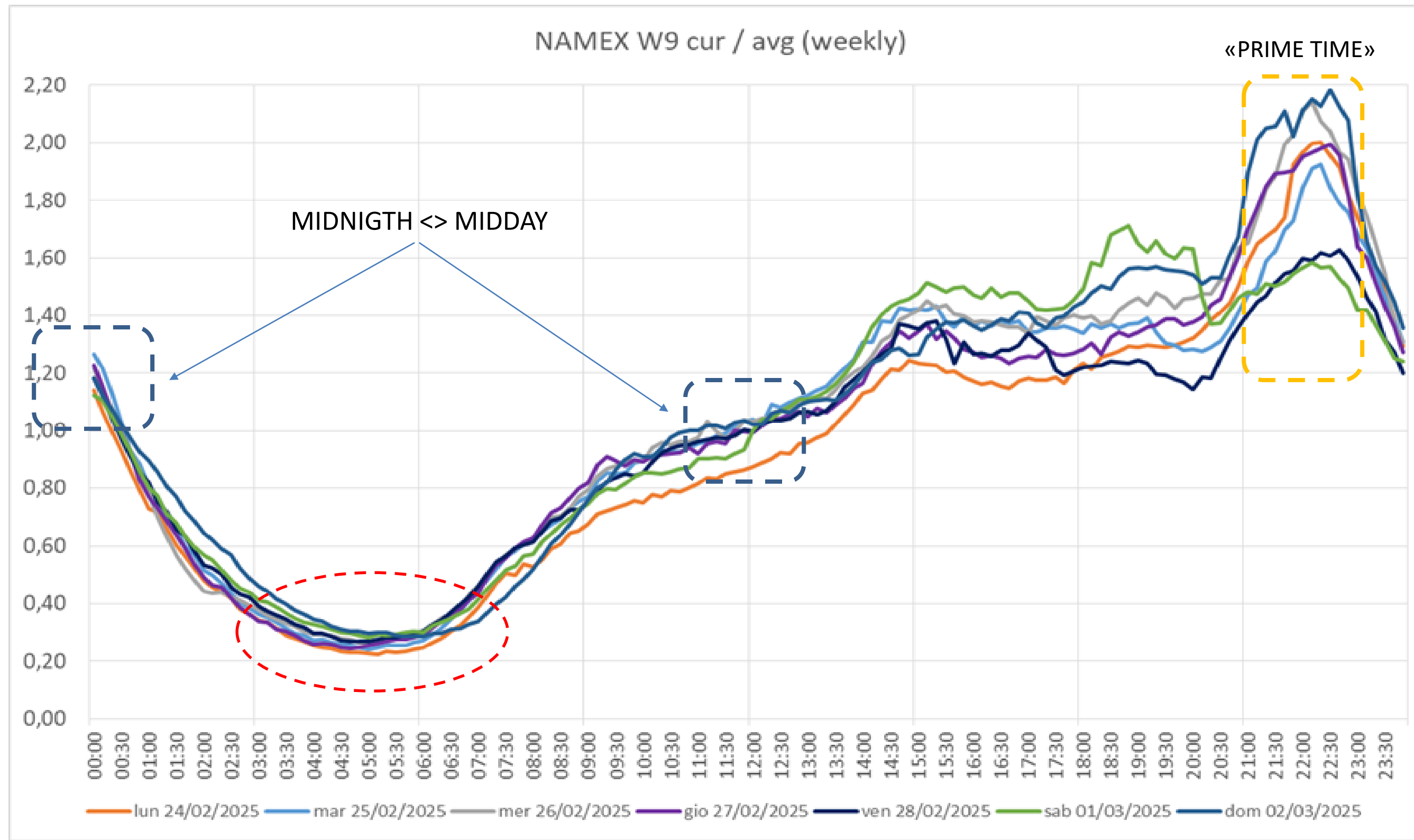
min-max normalization | mean normalization |
standardization (z-score) | modified z-score | ...

CORRELATION:

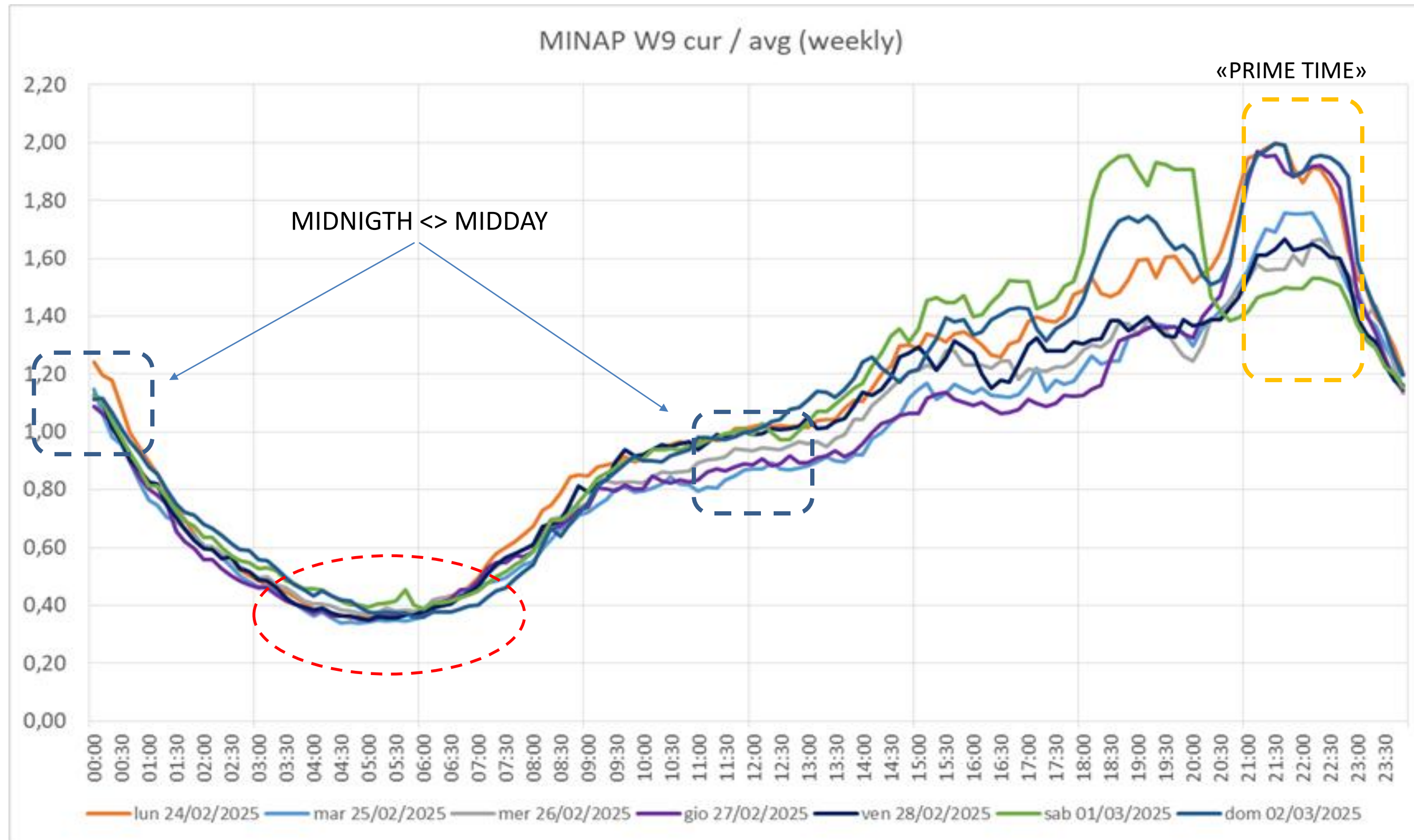
intra IXP / inter IXP correlation matrix | ...



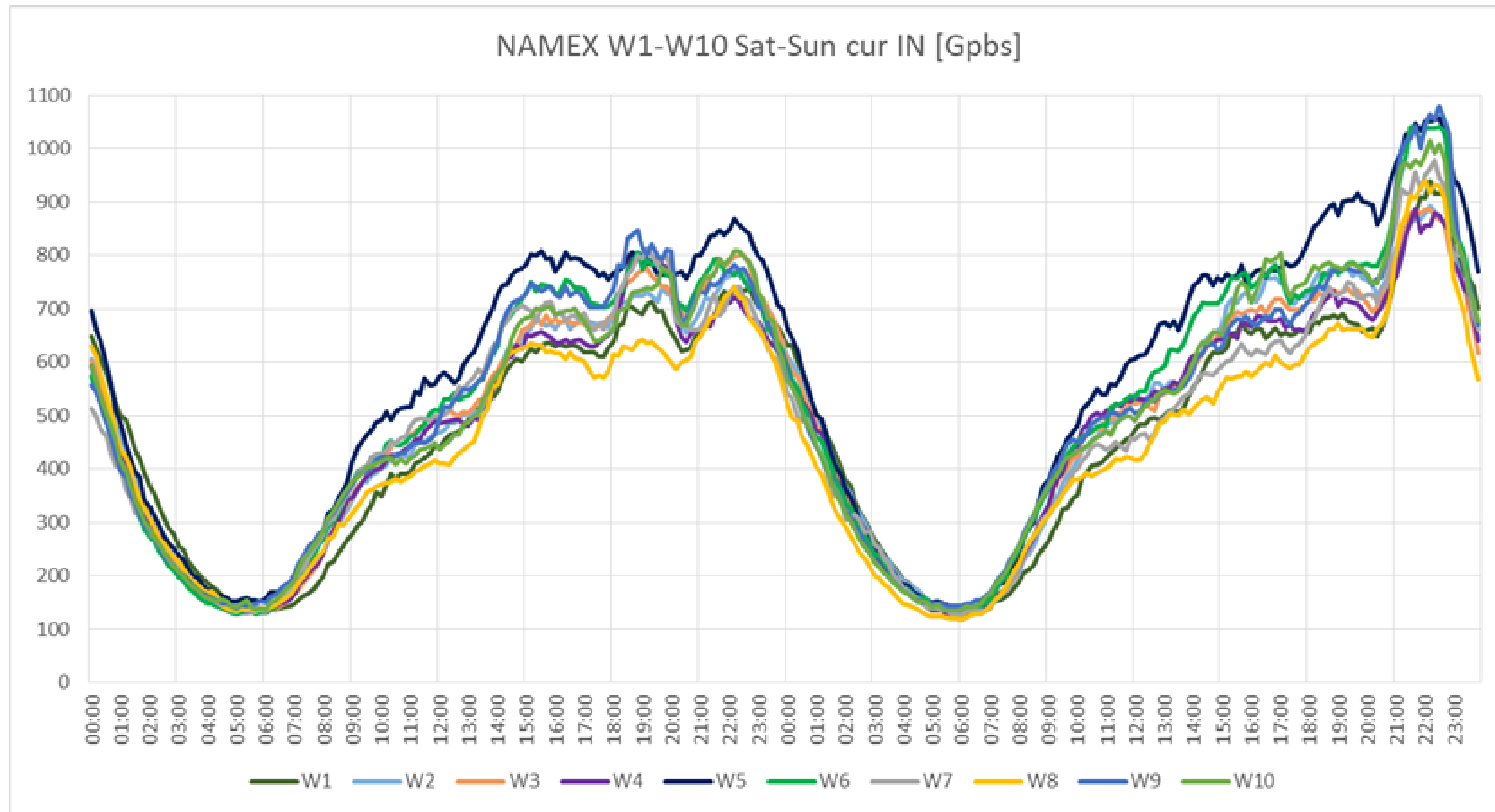
EX. 1: W9 NAMEX norm to W AVG



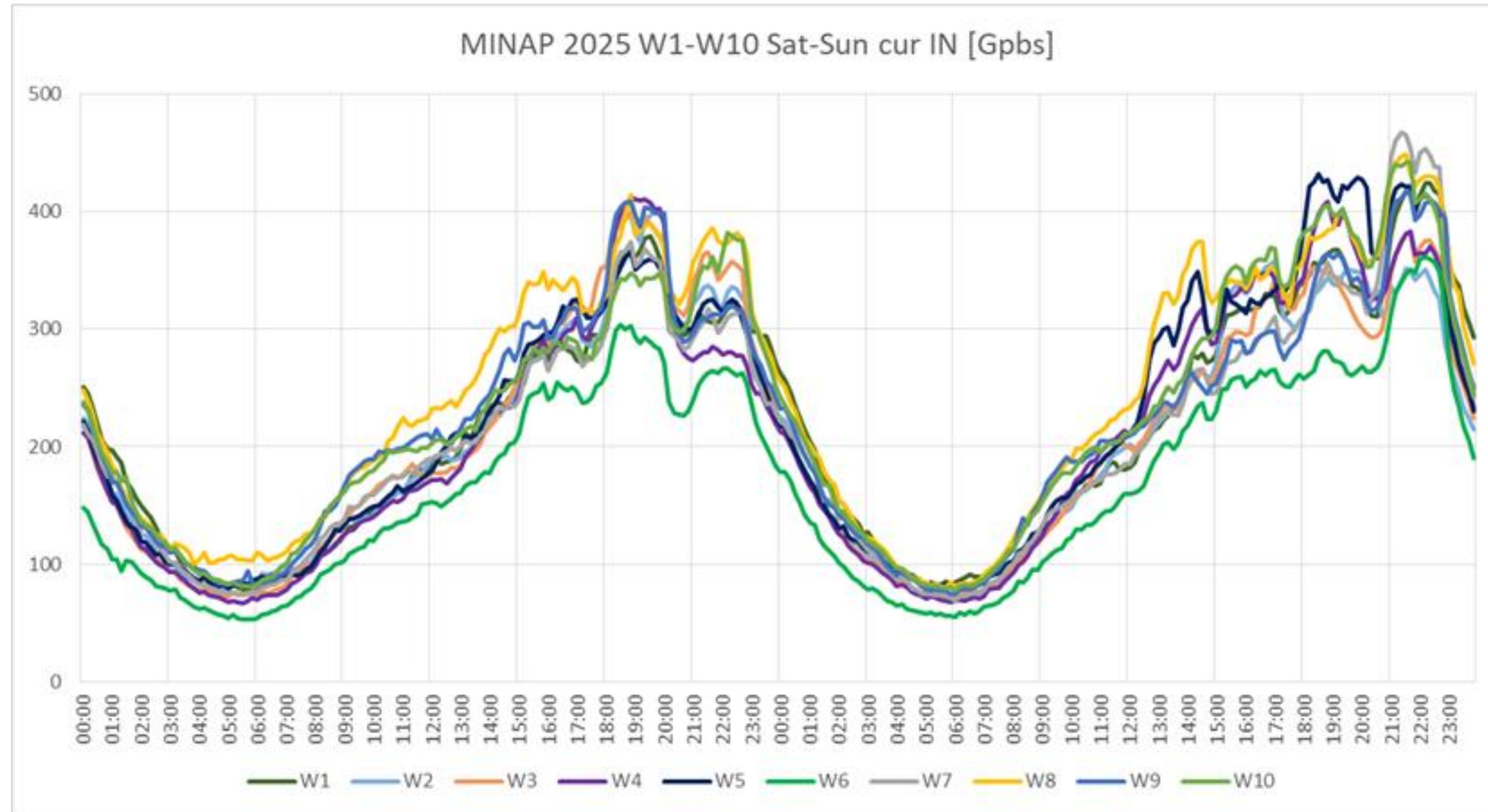
EX. 1: W9 MINAP norm to W AVG



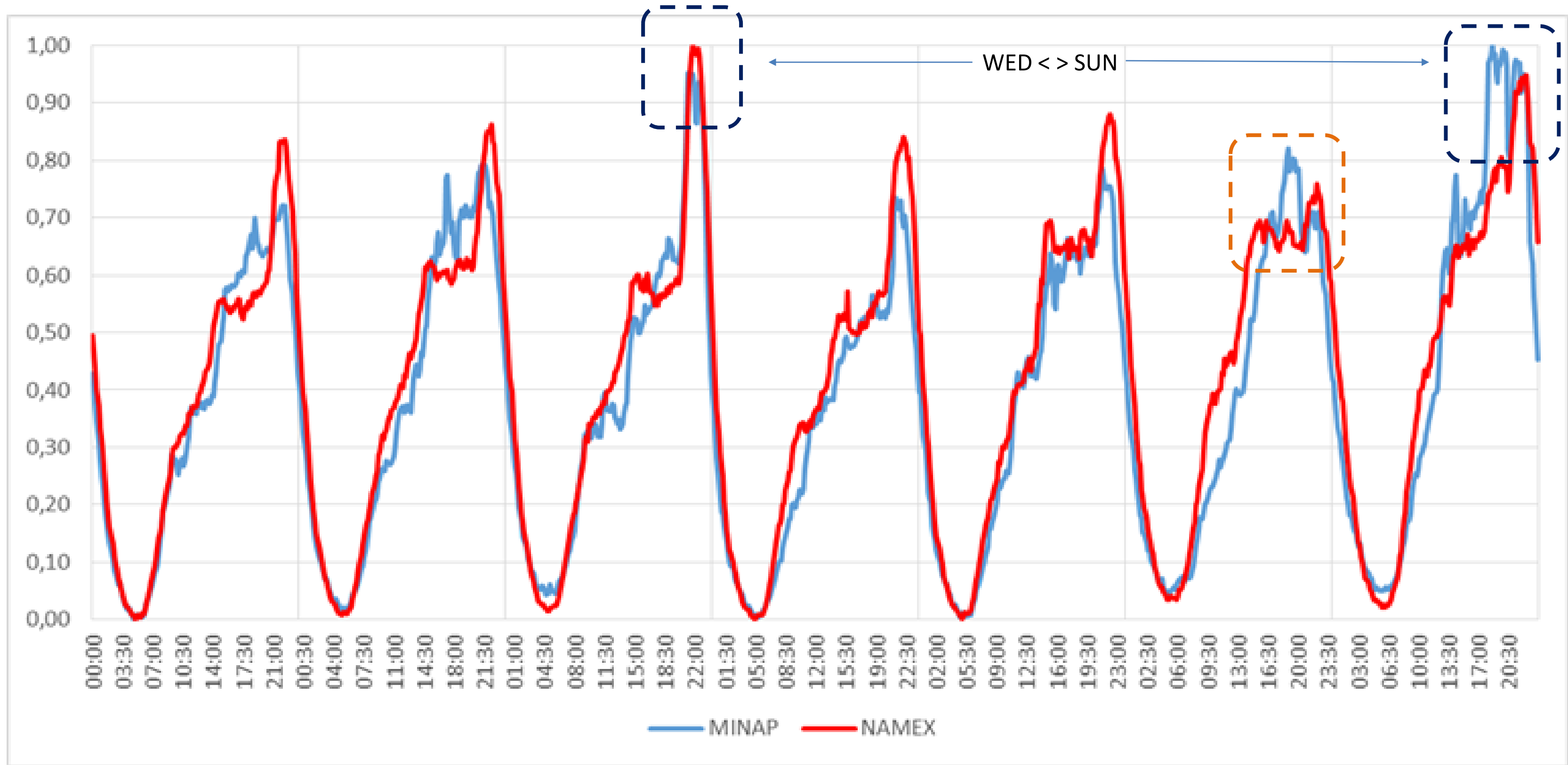
EX. 2: NAMEX 2025 W1-W10 Sat-Sun



EX. 2: MINAP 2025 W1-W10 Sat-Sun



EX. 3: W5 2025 MIN-MAX NORM W



IXP Peers (MINAP, NAMEX)

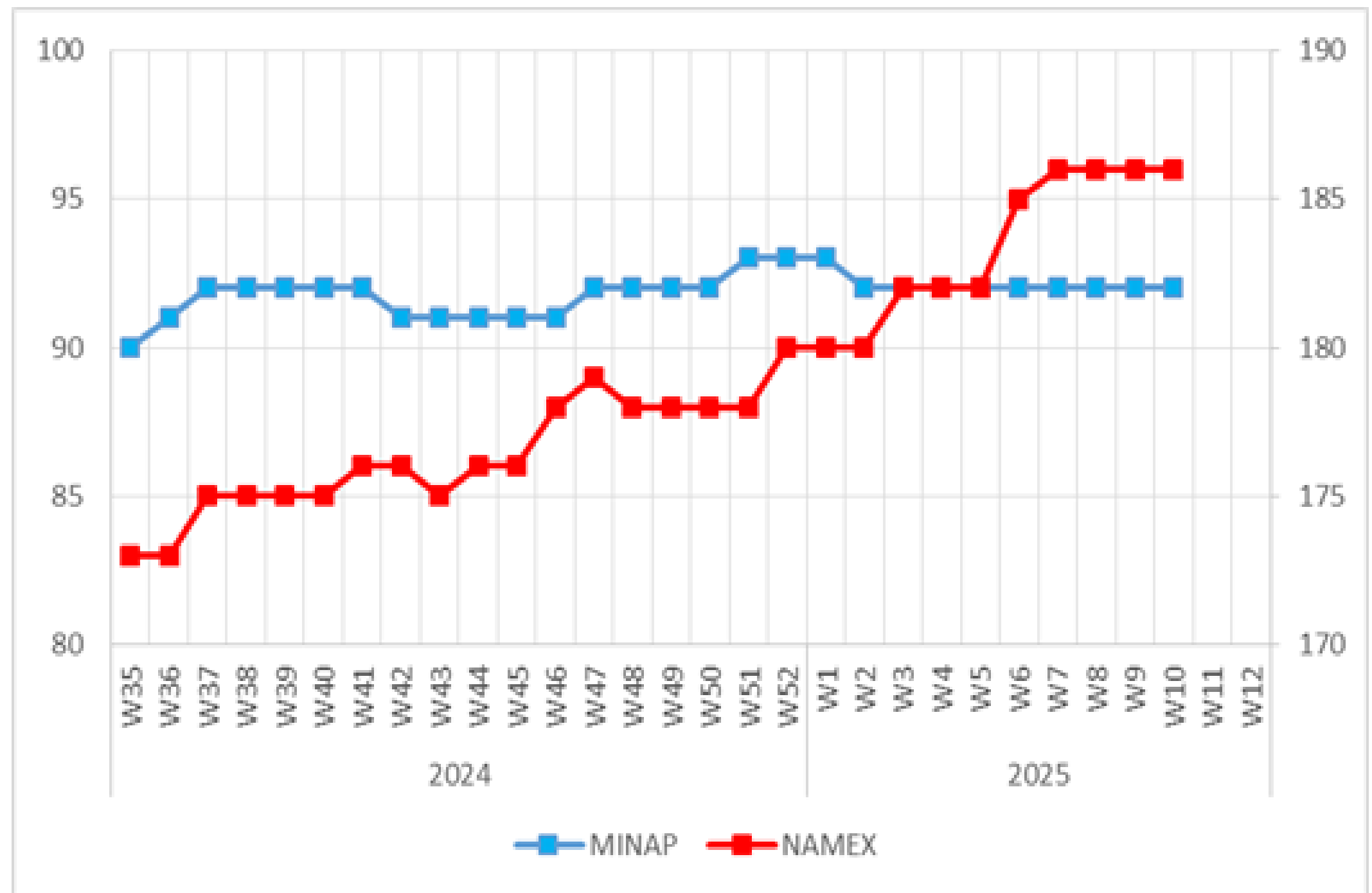
From PeeringDB
(Wed “sample”)

e.g. W9

```
20250226T190001Z  
IXPID, IXPName, Peers  
240, MINAP Milan, 92  
121, NameX Rome, 186  
48, INEX LAN1, 103  
387, INEX LAN2, 67  
53, LONAP, 287  
[...]
```

MINAP

NAMEX



1st SET: UEFA CL 2023-2024 KP

UEFA CHAMPIONS LEAGUE 2023-2024 – KNOCKOUT PHASE (8)

W7 – Wed 14/02/2024 – Round of 16: leg 1 of 2: Lazio – Bayern

W8 – Wed 21/02/2024 – Round of 16: leg 1 of 2: Napoli – Barcelona

W10 – Wed 06/03/2024 – Round of 16: leg 2 of 2: Real Madrid – RB Leipzig

W11 – Wed 13/03/2024 – Round of 16: leg 2 of 2: Atletico Madrid – Inter

W15 – Wed 10/04/2024 – Quarter-final: leg 1 of 2 : PSG – Barcelona

W16 – Wed 17/04/2024 – Quarter-final: leg 2 of 2 : Manchester City – Real Madrid

W18 – Wed 01/05/2024 – Semi-final: leg 1 of 2 : Borussia Dortmund – PSG

W19 – Wed 08/05/2024 – Semi-final: leg 2 of 2 : Real Madrid – Bayern

No Italian teams qualified



2nd SET: UEFA CL 2024-2025 LP

UEFA CHAMPIONS LEAGUE 2024-2025 – LEAGUE PHASE (8)

W38 – Wed 18/09/2024 – Matchday 1 : Manchester City – Inter

W40 – Wed 02/10/2024 – Matchday 2 : RB Leipzig – Juventus

W43 – Wed 23/10/2024 – Matchday 3 : Young Boys – Inter

W45 – Wed 06/11/2024 – Matchday 4 : Inter – Arsenal

W48 – Wed 27/11/2024 – Matchday 5 : Aston Villa – Juventus

W50 – Wed 11/12/2024 – Matchday 6 : Juventus – Manchester City

W4 – Wed 22/01/2025 – Matchday 7 : Milan – Girona

W5 – Wed 29/01/2025 – Matchday 8 : Inter – AS Monaco



3rd SET: UEFA CL 2024-2025 KP

UEFA CHAMPIONS LEAGUE 2024-2025 – KNOCKOUT PHASE (4)

W7 – Wed 22/01/2025 – Play-offs: Leg 1 of 2 : Feyenoord – Milan

W8 – Wed 29/01/2025 – Play-offs: Leg 2 of 2 : PSV Eindhoven – Juventus

W10 – Wed 05/03/2025 – Round of 16: Leg 1 of 2 : Feyenoord – Inter (18:45)

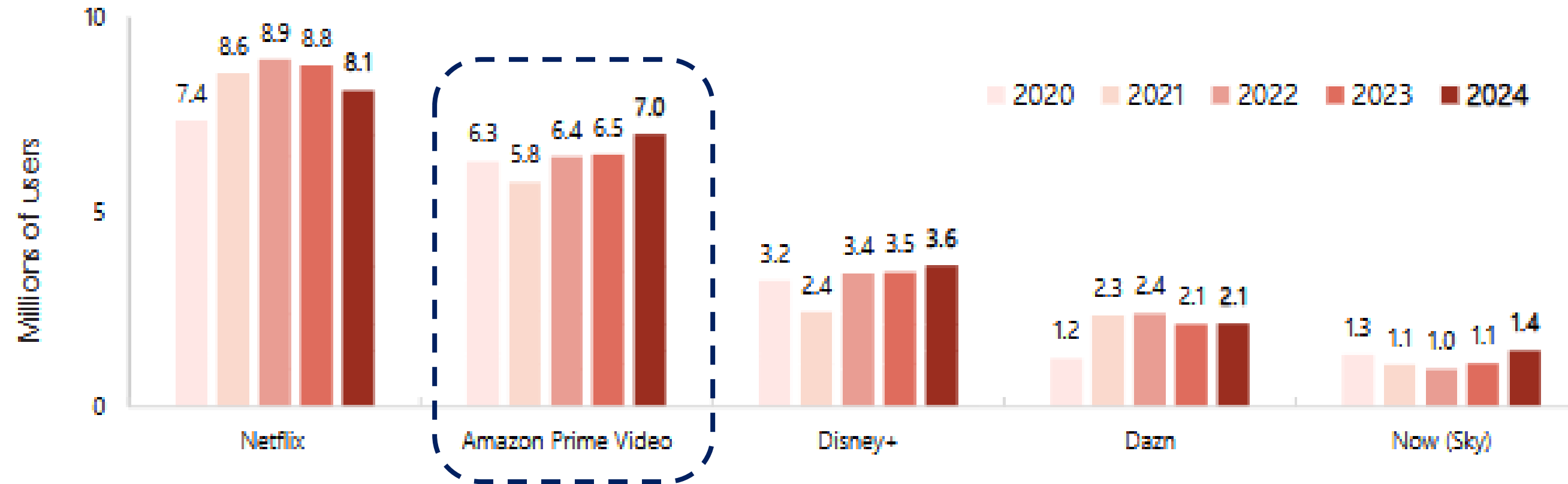
W11 – Wed 12/03/2025 – Round of 16: Leg 2 of 2 : Atletico Madrid – Real Madrid

W15 – Wed 09/04/2025 Quarter-final: Leg 1 of 2:

W16 – Wed 16/04/2025 Quarter-final: Leg 1 of 2:



UNIQUE USERS OF THE MAIN PLATFORMS* (average since the beginning of the year Jan. – Sep..)



* Note: platforms with an average time spent by users more than 7 minute are represented

Source: AGCOM (AGENZIA PER LE GARANZIE NELLE COMUNICAZIONI <https://www.agcom.it>)



https://www.agcom.it/sites/default/files/media/allegato/2024/AGCOM_Osservatorio%20n.4-2024%20english%20version_0.pdf



UEFA CL 2023–2024 metrics

TIPICAL MATCH TIMEFRAME : 9PM – 11PM (O.T. excluded)

**Introducing a new metric “prime time average” (~ 21:00 to ~ 23:00)
e.g.: NAMEX W10 to W19 (CL 2023–2024 part of KP)**

Week	95p [Gbps]	`PTA' [Gbps]	
W10	571,312	569,796	(Round of 16 – leg 2 of 2)
W11	649,821	648,477	(Round of 16 – leg 2 of 2)
W12	506,418	510,878	
W13	562,974	567,429	
W14	516,808	520,200	
W15	629,943	620,078	(Quarter-final – leg 1 of 2)
W16	654,434	646,142	(Quarter-final – leg 2 of 2)
W17	514,737	518,755	
W18	690,143	688,400	(Semi-final – leg 1 of 2)
W19	690,300	679,186	(Semi-final – leg 2 of 2)



UEFA CL 2024-2025 metrics

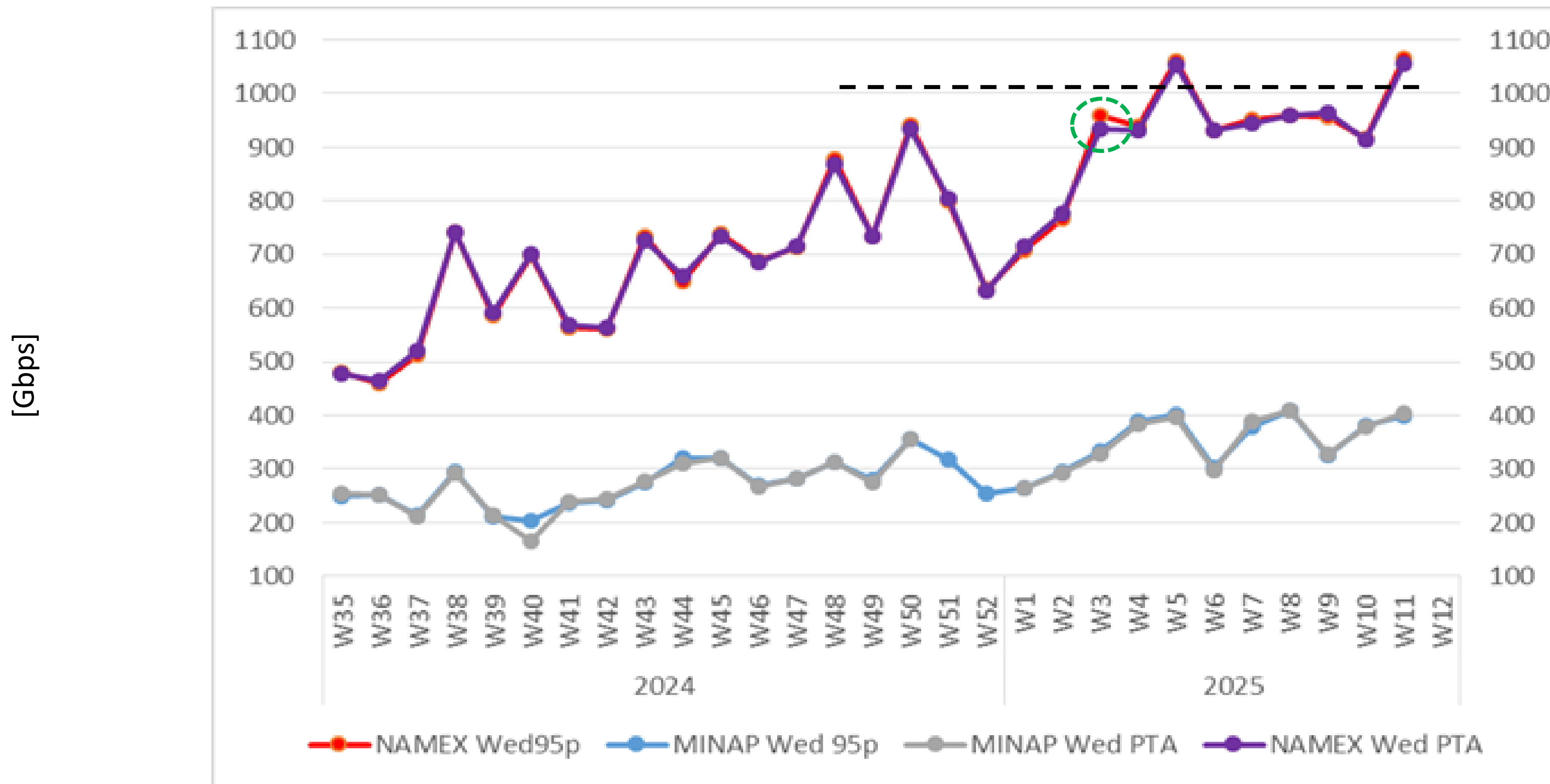
TIPICAL MATCH TIMEFRAME : 9PM – 11PM (O.T. excluded)

**Introducing a new metric “prime time average” (~ 21:00 to ~ 23:00)
e.g.: NAMEX W35 to W43 (CL 2024-2025 1st part of LP)**

Week	95p [Gbps]	'PTA' [Gbps]	
W35	480,262	476,820	
W36	459,046	464,691	
W37	512,678	520,378	
W38	740,499	740,179	(League Phase – Matchday 1)
W39	585,568	592,162	
W40	698,786	699,520	(League Phase – Matchday 2)
W41	564,001	568,717	
W42	559,916	563,758	
W43	732,894	724,681	(League Phase – Matchday 3)
W44	649,214	659,368	

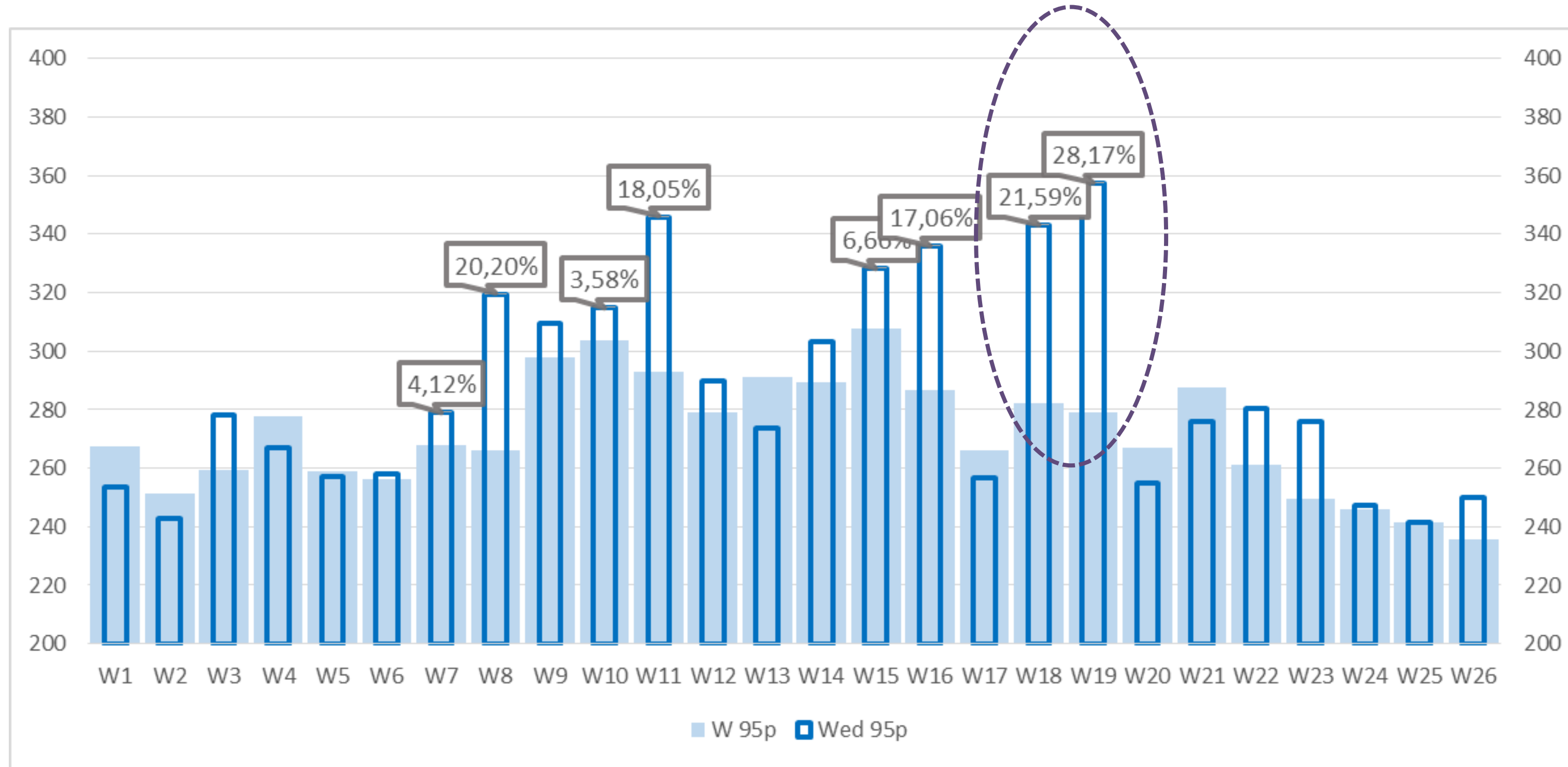


Wed 95p <> PTA (Sep 2024 – Mar 2025)



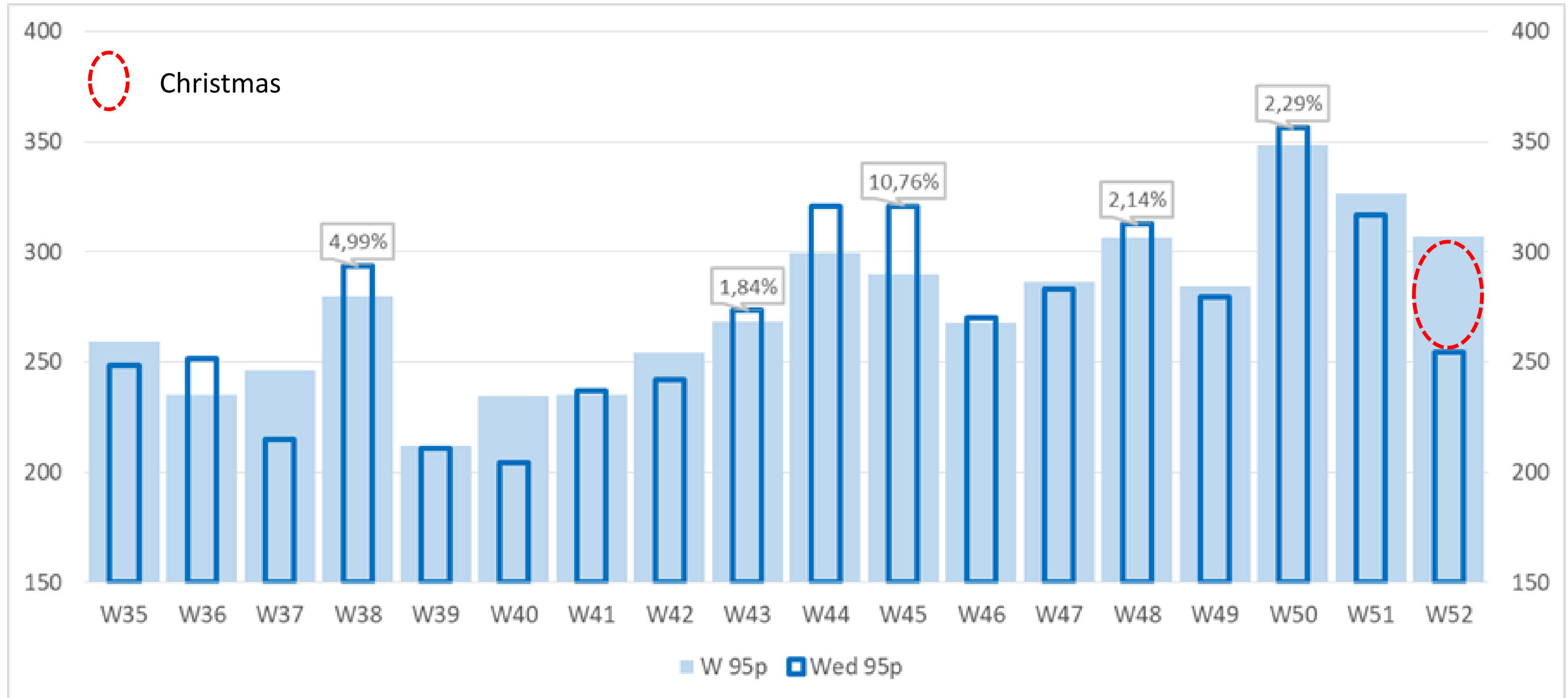
MINAP CL 2023-2024 KP (1H2024)

UEFA CL 2023-2024 Knockout Phase [Gbps]



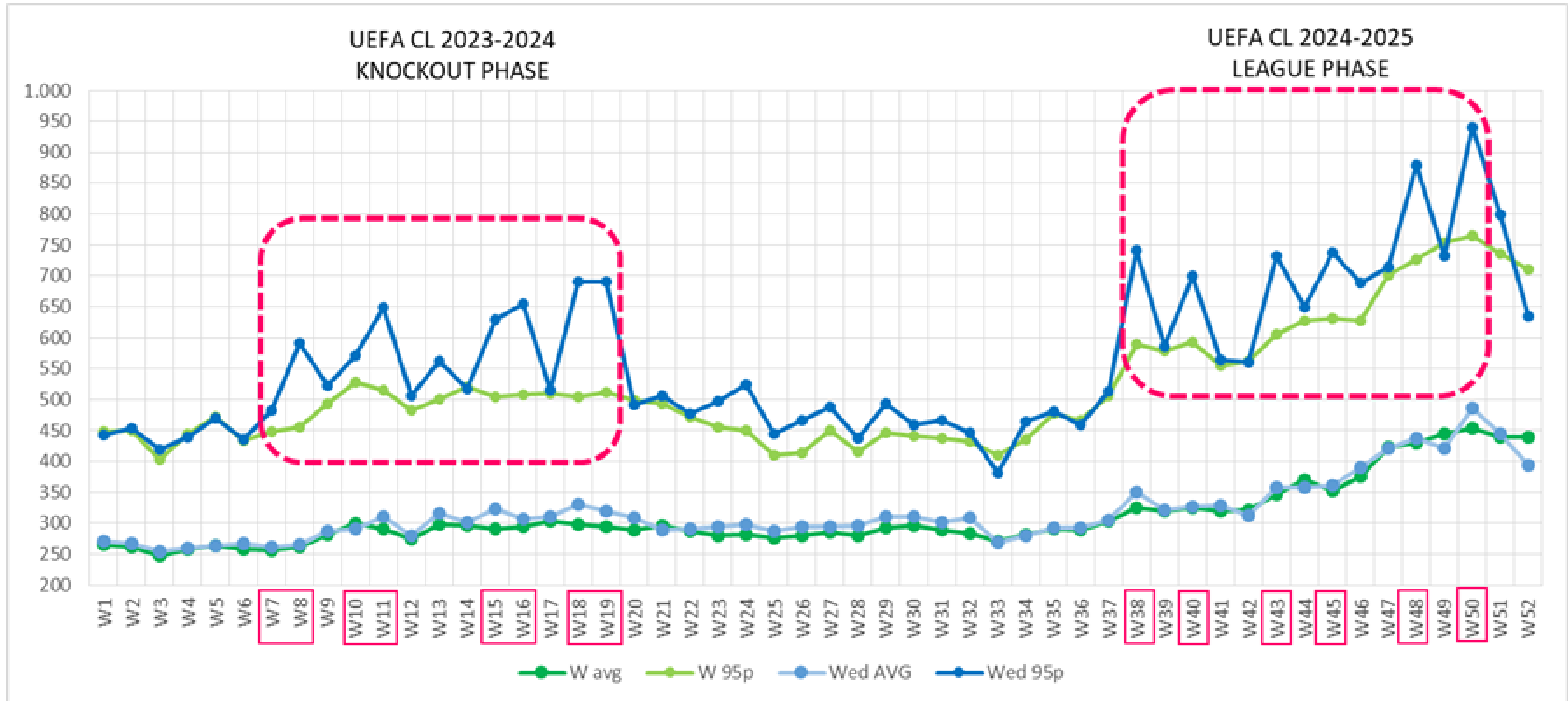
MINAP CL 2024-2025 LP (2H2024)

UEFA CL 2024-2025 League Phase [Gbps]



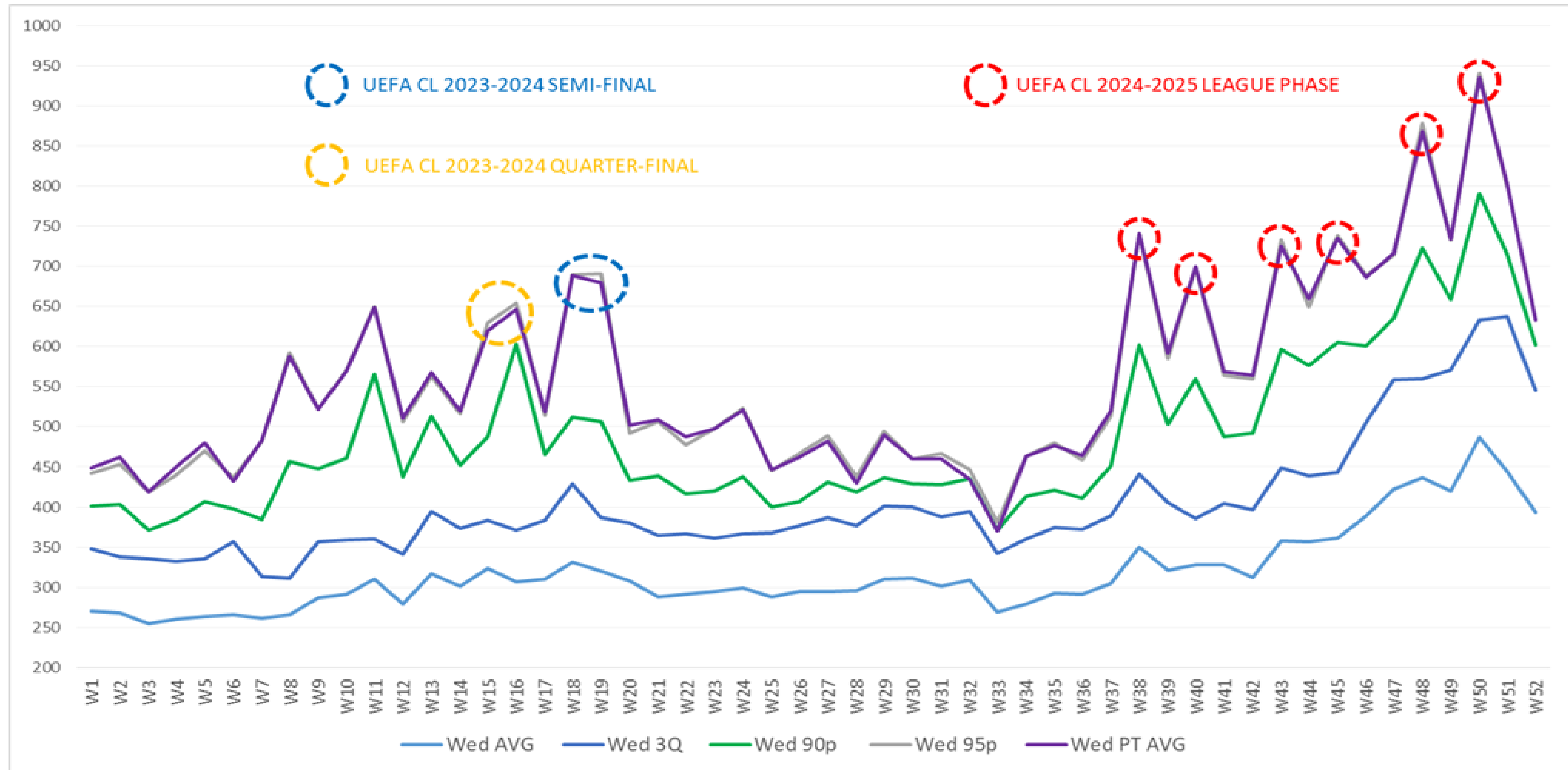
NAMEX 2024 WEEK<>WED TRAFFIC

UEFA CL 2023-2024 KP | UEFA CL 2024-2025 LP [Gbps]



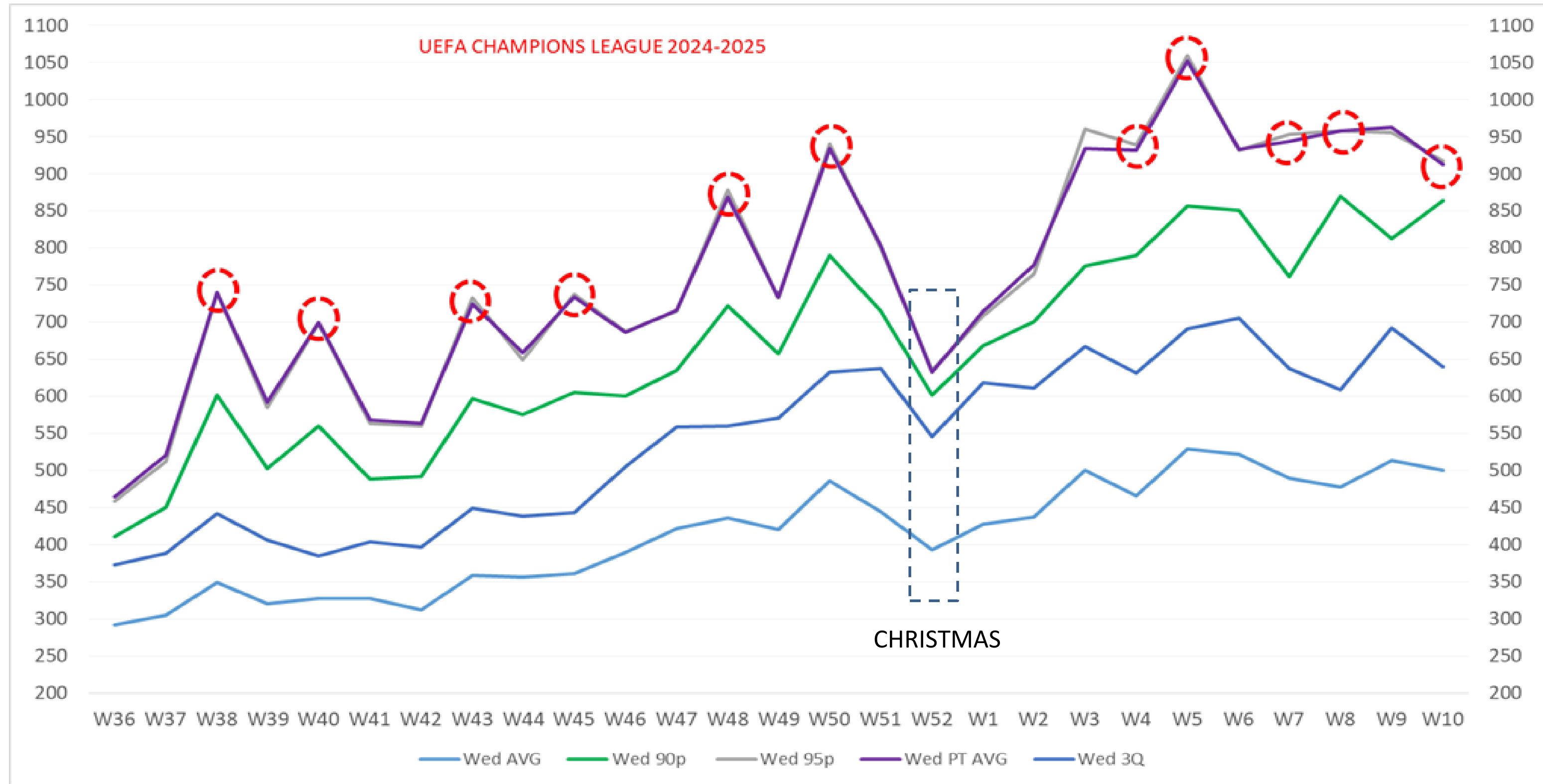
NAMEX 2024 WED TRAFFIC

UEFA CL 2023-2024 KP | UEFA CL 2024-2025 LP [Gbps]



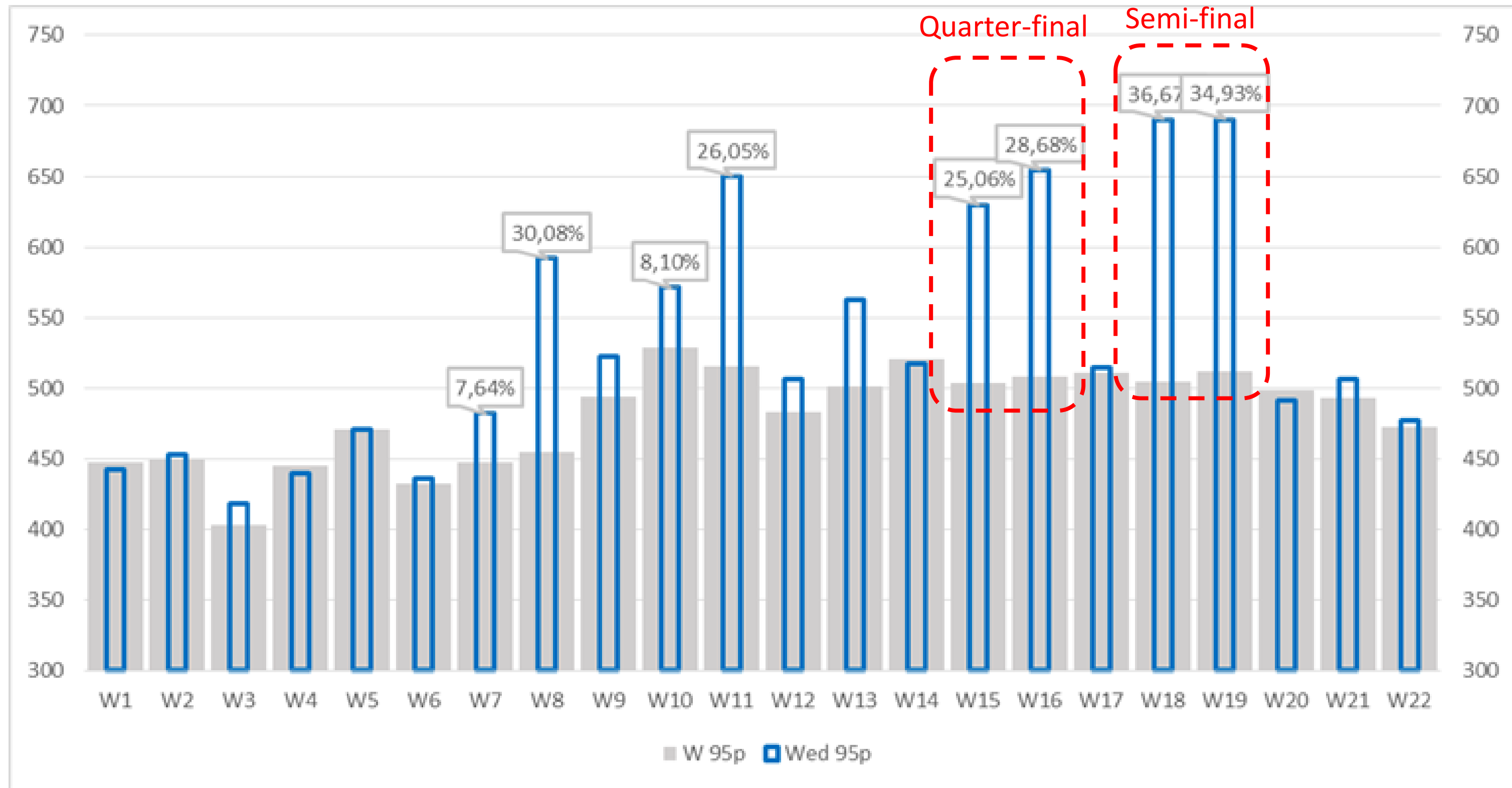
NAMEX CL 2024-2025 WED TRAFFIC

UEFA CL 2024-2025 LP / KP [Gbps]



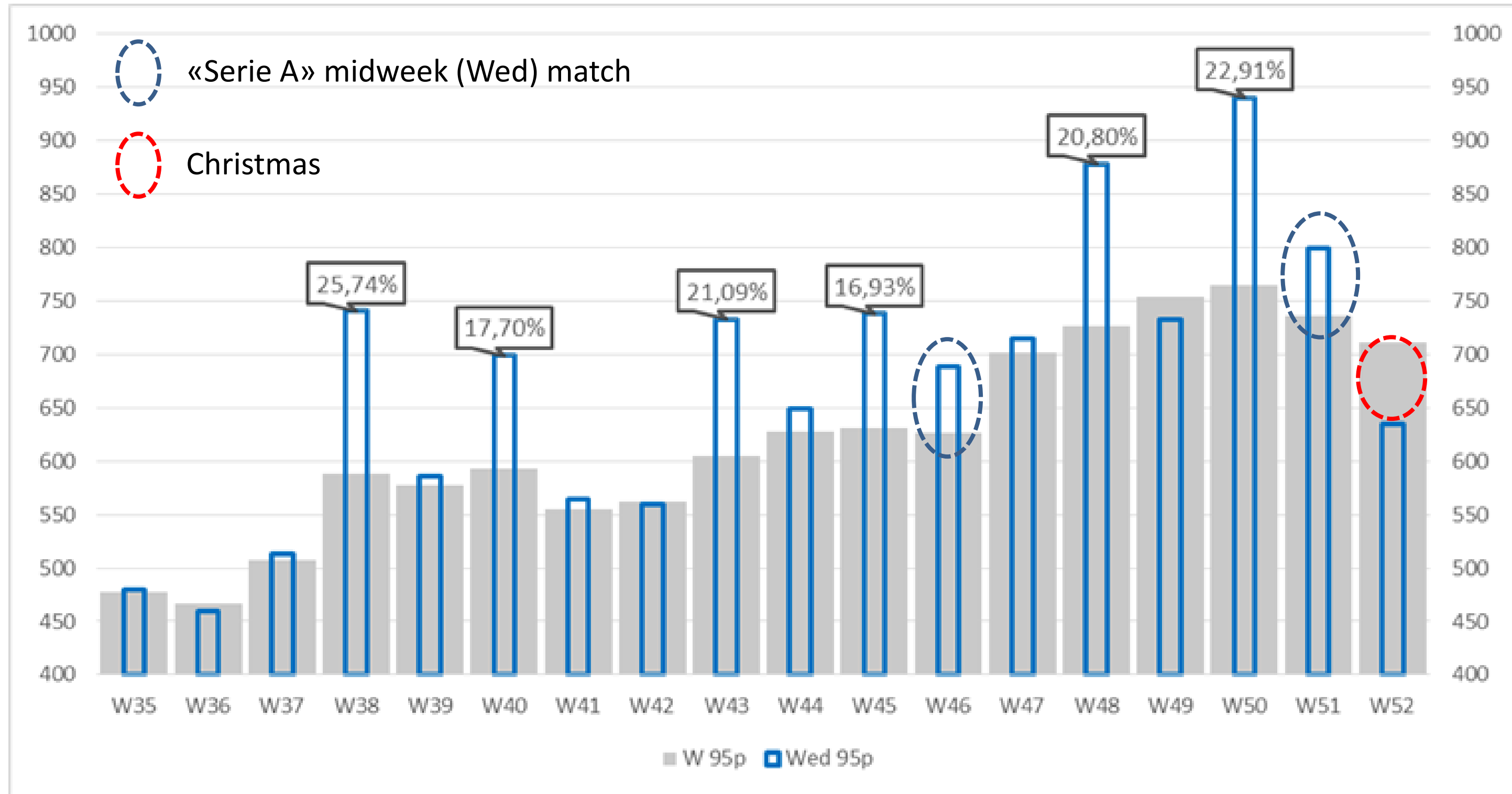
NAMEX 2024 95p W <> Wed / 1

UEFA CL 2023-2024 KP – Feb-May 2024 [Gbps]



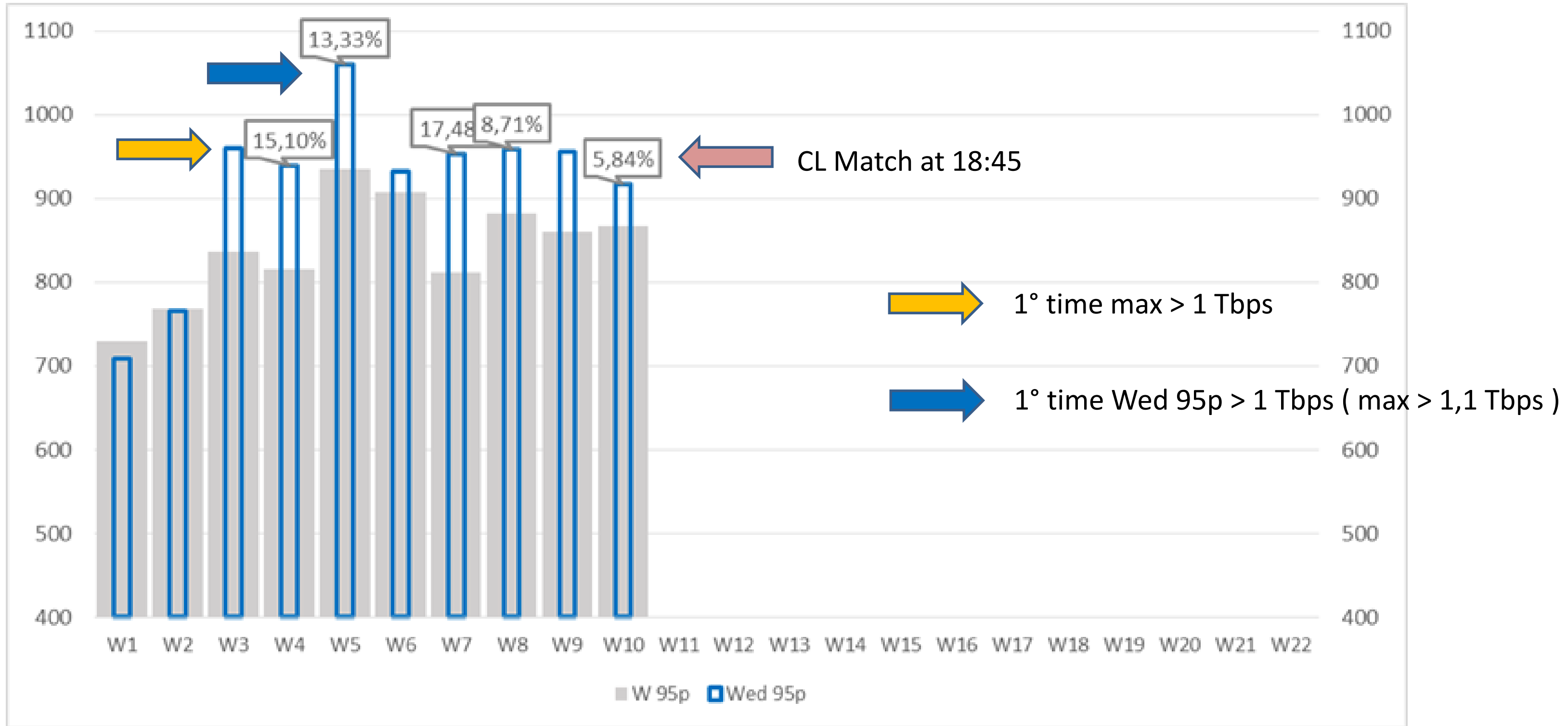
NAMEX 2024 95p W <> Wed / 2

UEFA CL 2024-2025 LP – Sep-Dec 2024 [Gbps]



NAMEX 2025 95p W <> Wed / 1

UEFA CL 2024-2025 LP KP – Jan-Mar 2025 [Gbps]



NAMEX 2024 ALL-TIME PEAKS

All-time 2024 traffic peak progression [W,UTC time,bps]

W11,"2024-03-13T21:05:00.000000Z",696265840024
W16,"2024-04-17T21:00:00.000000Z",702198482352
W18,"2024-05-01T20:20:00.000000Z",737218269208
W38,"2024-09-18T20:05:00.000000Z",781041256560
W48,"2024-11-25T21:10:00.000000Z",800043455256 (Monday)
W48,"2024-11-27T21:00:00.000000Z",905423312552
W50,"2024-12-11T21:10:00.000000Z",968262734872

6 on 7 2024 traffic peaks on Wednesday night during CL matches

Note on W19 (NAMEX):

"2024-05-08T20:25:00.000000Z",733350129168

W19 → 2024 peak traffic night @ MINAP (and also @ MIX)



NAMEX 2025 ALL-TIME PEAKS

All-time 2025 traffic peak progression [W,UTC time,bps]

W3,"2025-01-15T20:35:00.000000Z",1001505431128

W5,"2025-01-29T20:40:00.000000Z",1122739909736

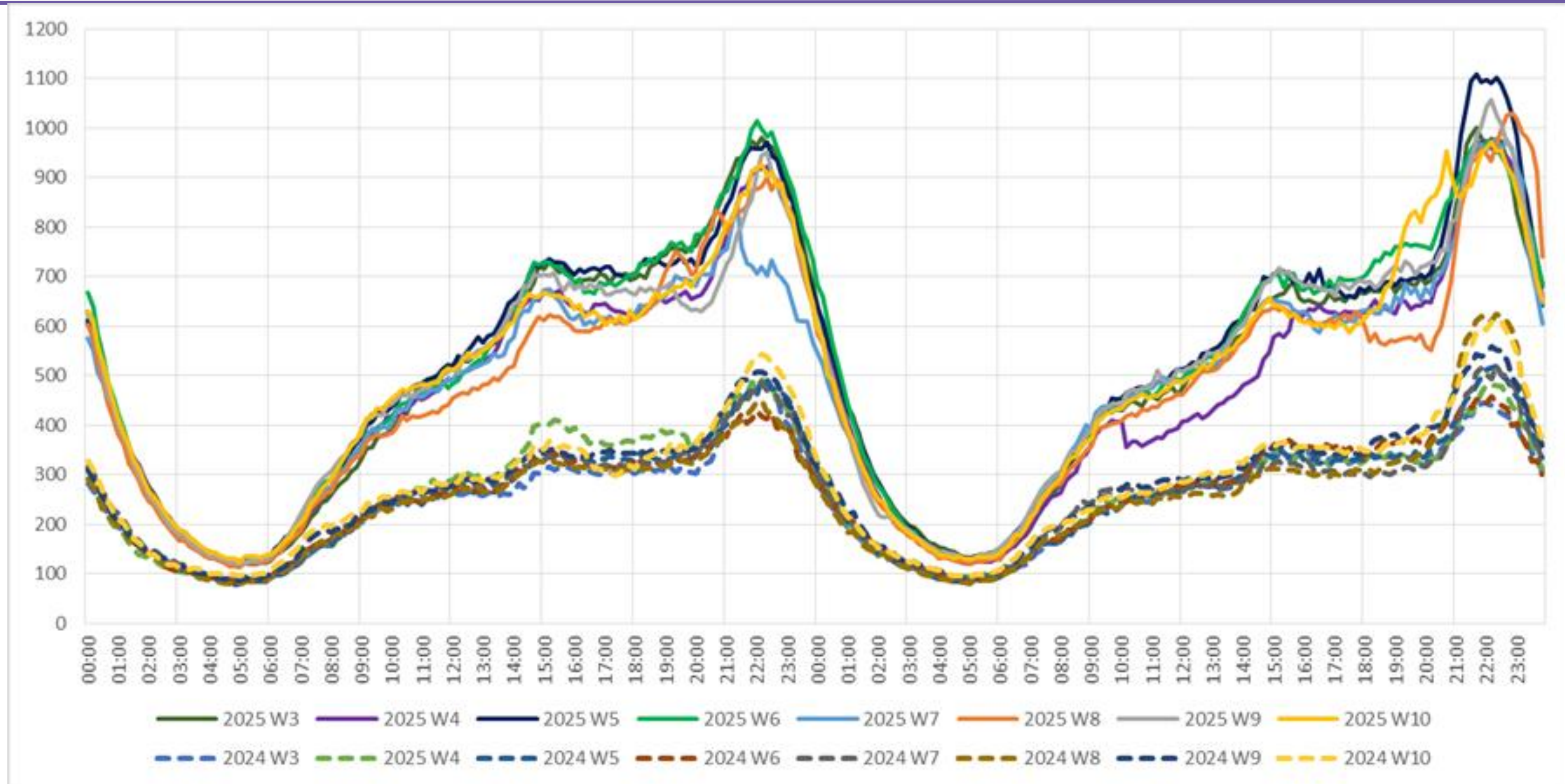
(... and counting)

2025 days with traffic peaks > 1 Tbps:

2025-01-15 (Wed)	2025-02-19 (Wed)	2025-03-12 (Wed)
2025-01-29 (Wed)	2025-02-26 (Wed)	
2025-02-02 (Sun)	2025-03-02 (Sun)	
2025-02-03 (Mon)	2025-03-03 (Mon)	
2025-02-10 (Mon)	2025-03-09 (Sun)	



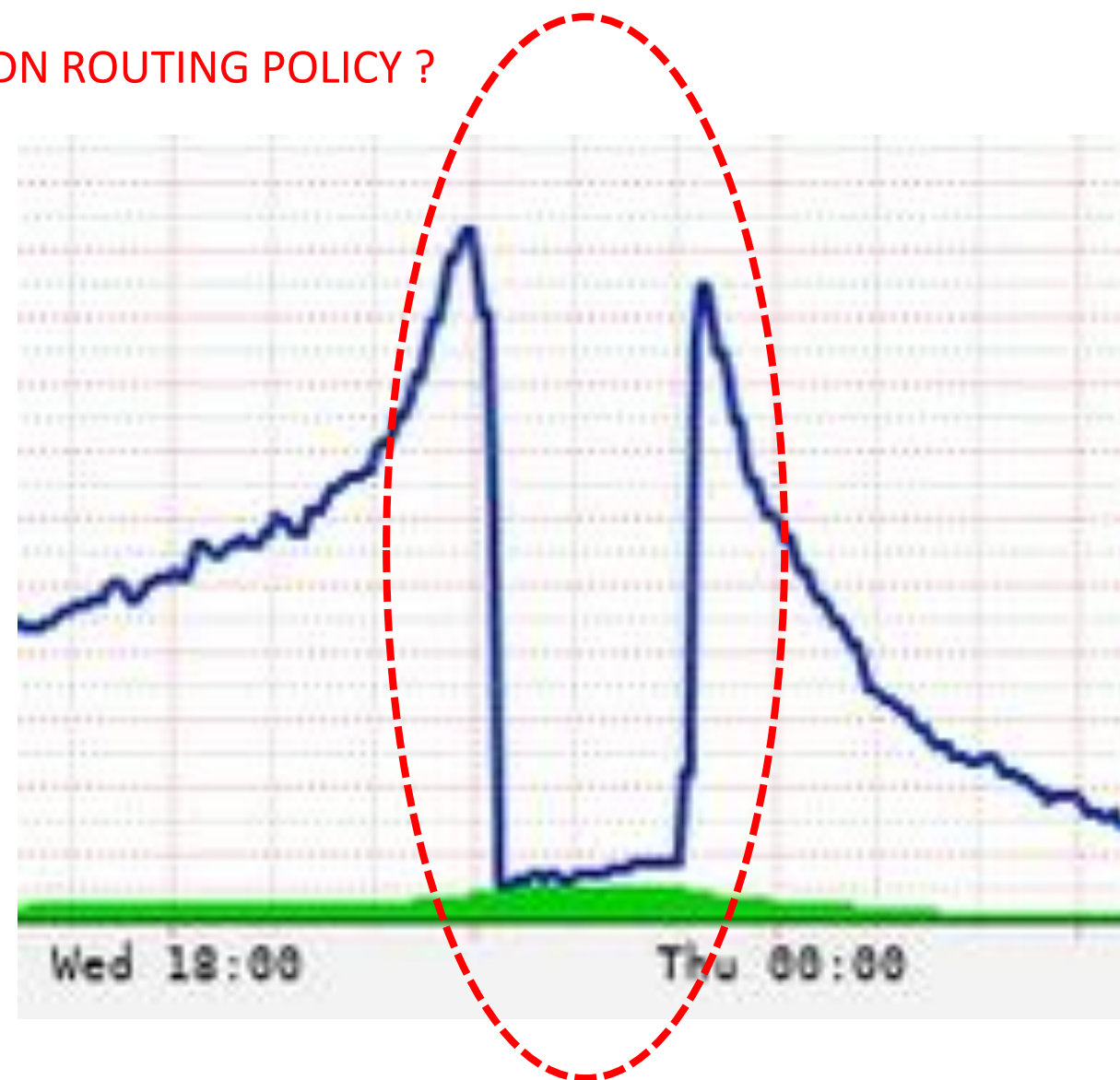
NAMEX Y2Y Tue-Wed (W3-W10)



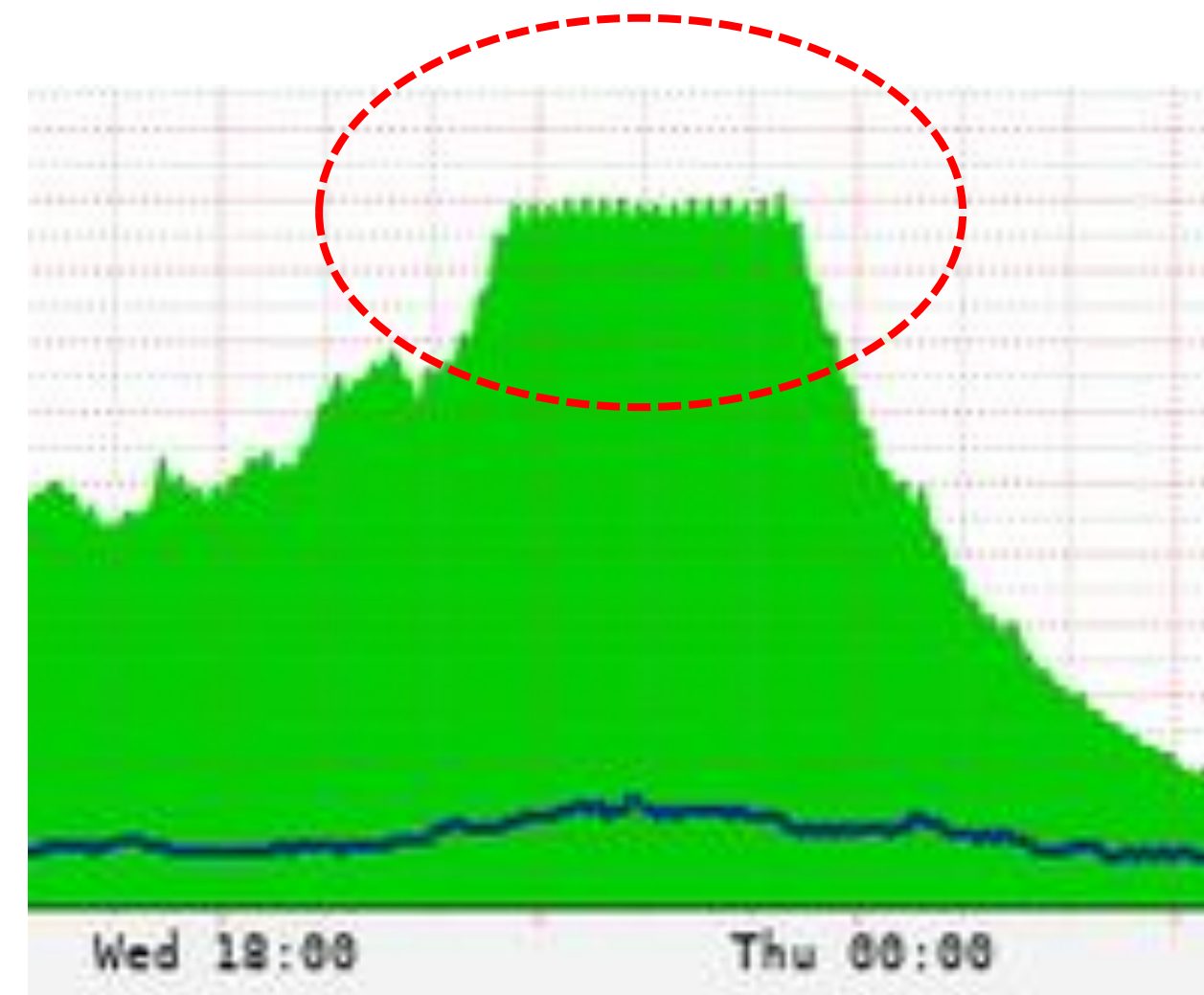
THINGS TO AVOID ?

A couple of “issues” faced during CL matches (@ MINAP)

CDN ROUTING POLICY ?



ISP - AVOID MAINTENANCE ?



SOME NOTES AND CONCLUSIONS

- **Wednesdays (and Sundays) are the days with most traffic**
- **Traffic humps/peaks are almost always related to live football streaming**
- **Metric “PTA” seems consistent with 95th percentile (W.I.P)**
- **NAMEX “all-time” peaks almost always on Wed nights (most of them are UEFA CL Wed nights)**
- **CL edition 2023–2024 (quarter–final and semi–final) :
NAMEX deviations (Wed 95p <> Week 95p) ~ 25% to ~ 35% up**
- **CL edition 2024–2025 League Phase (2024 matchdays):
NAMEX deviations (Wed 95p <> Week 95p) ~ 17% to ~ 25% up**



QUESTIONS?

COMMENTS? SUGGESTIONS?



THANK YOU FOR YOUR ATTENTION

Gianluca Sironi NAQUADRIA | PCIX

