

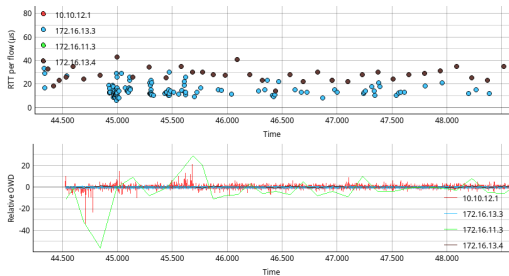
# Detection of shared network bottleneck using passive WiFi traffic analysis

Oskar Haukebø

December 14, 2023

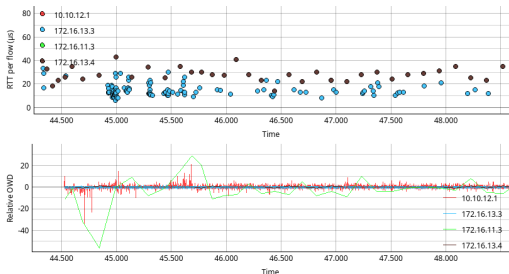
# NETHINT

## ► Part of earlier master thesis



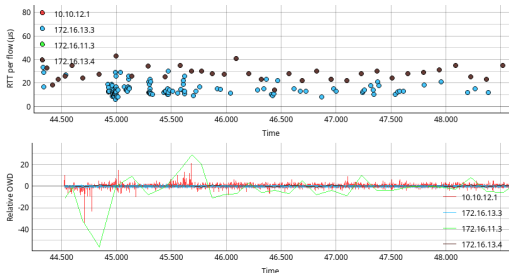
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- ▶ Part of earlier master thesis
- ▶ Determine whether network congestion is located on local WiFi or not



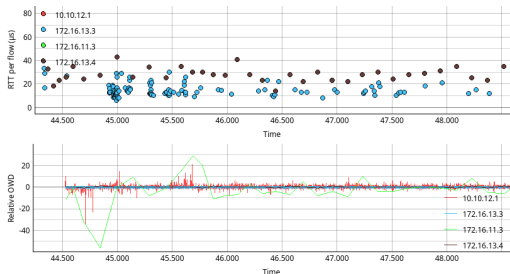
# NETHINT

- ▶ Part of earlier master thesis
- ▶ Determine whether network congestion is located on local WiFi or not
- ▶ Know whether you can blame your family for slow internet



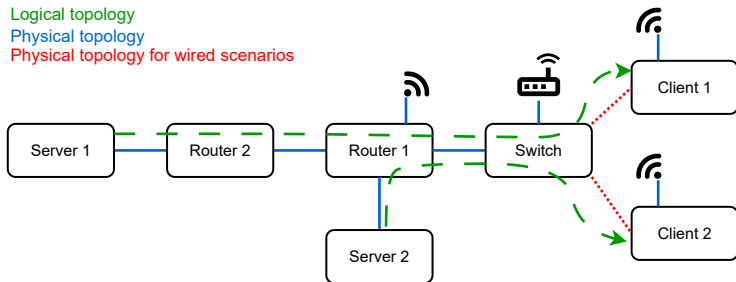
# NETHINT

- ▶ Part of earlier master thesis
- ▶ Determine whether network congestion is located on local WiFi or not
- ▶ Know whether you can blame your family for slow internet
- ▶ Only uses passive measurements

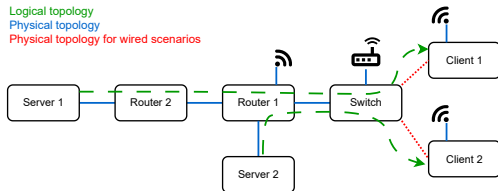


# TEACUP

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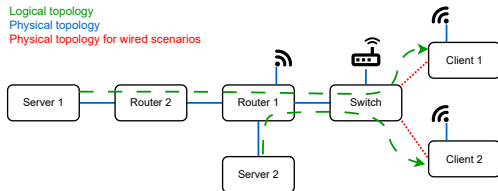
# Traffic generation



- Server 2 → Client 2: Always the same VoIP traffic

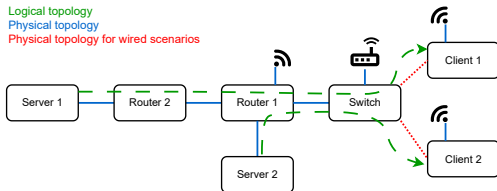


# Traffic generation



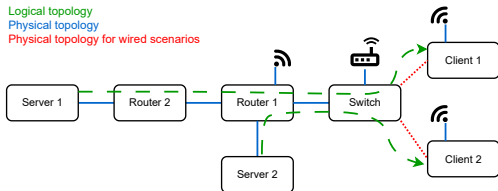
- ▶ Server 2 → Client 2: Always the same VoIP traffic
- ▶ Server 1 → Client 1:

# Traffic generation



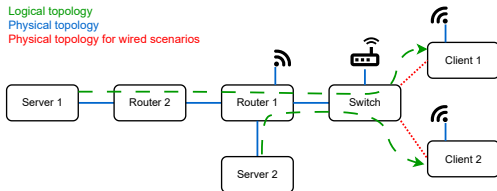
- ▶ Server 2 → Client 2: Always the same VoIP traffic
- ▶ Server 1 → Client 1:
  - ▶ Three Reno flows

# Traffic generation



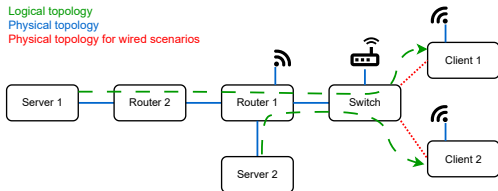
- ▶ Server 2 → Client 2: Always the same VoIP traffic
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  - ▶ Three Cubic flows

# Traffic generation



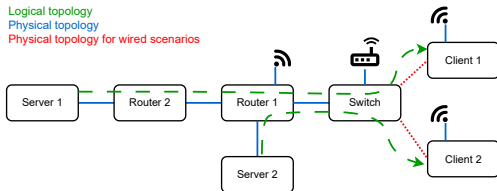
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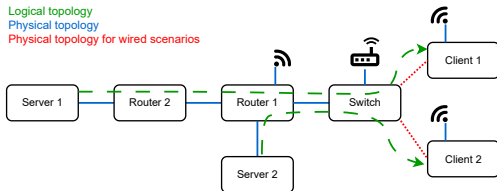
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# Traffic generation



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  - ▶ One of each
  - ▶ The above, but also with VoIP

# Router settings



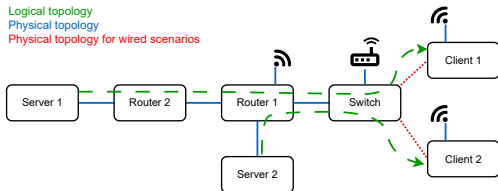
## Buffer lengths at Router 1

- ▶ 0.5 BDP
- ▶ 1 BDP
- ▶ 1.5 BDP
- ▶ 2 BDP

## Delay

- ▶ 10ms
- ▶ 50ms

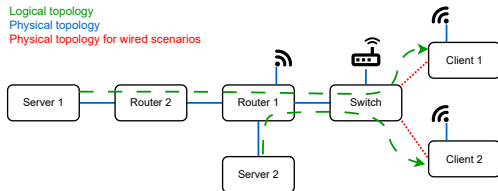
# Some fun numbers



- 64 different BDP + delay + capacity configurations

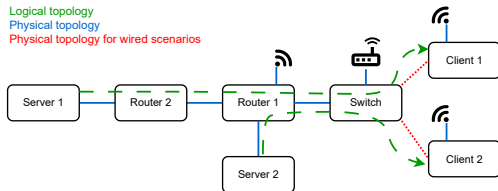


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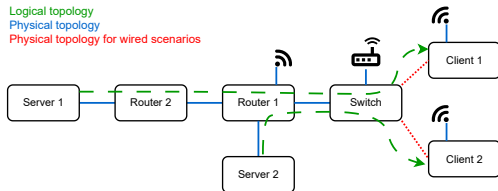
- ▶ 64 different BDP + delay + capacity configurations
- ▶ 192 total tests

# Some fun numbers



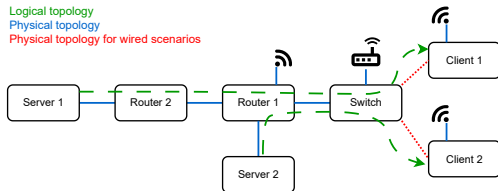
- ▶ 64 different BDP + delay + capacity configurations
- ▶ 192 total tests
- ▶ 16 Hours of test time

# Some fun numbers



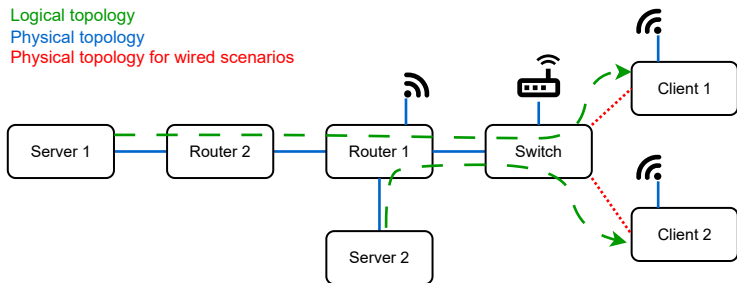
- ▶ 64 different BDP + delay + capacity configurations
- ▶ 192 total tests
- ▶ 16 Hours of test time
- ▶ >20 hours of TEACUP run time

# Some fun numbers



- ▶ 64 different BDP + delay + capacity configurations
- ▶ 192 total tests
- ▶ 16 Hours of test time
- ▶ >20 hours of TEACUP run time
- ▶ ~85 000 000 datapoints in total

# The correlation



See if the OWD of packets traveling towards Client 1 and Client 2 are correlated

# The correlation

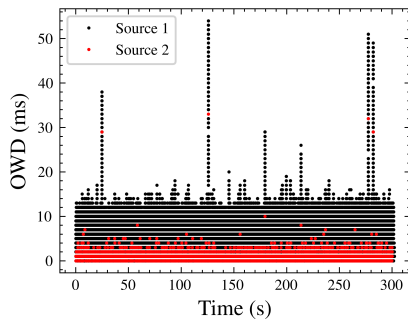


Figure: No common bottleneck

# The correlation

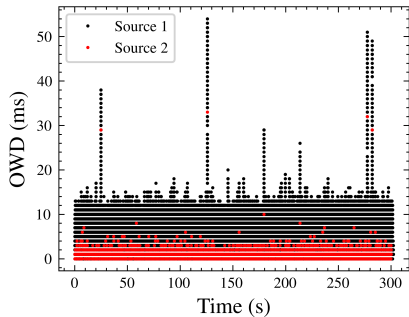


Figure: No common bottleneck

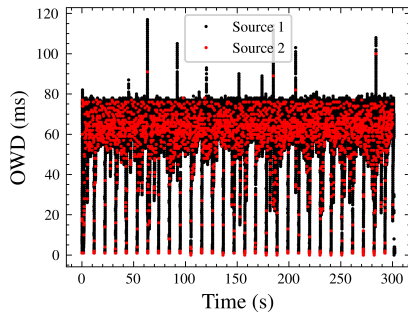


Figure: Common bottleneck

# The correlation

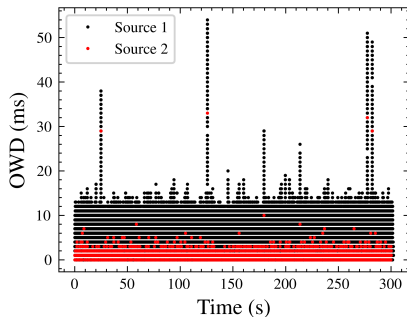


Figure: No common bottleneck

► Correlation: 0.20

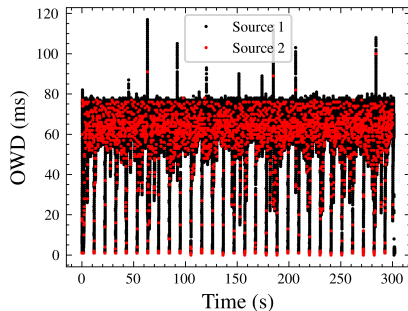
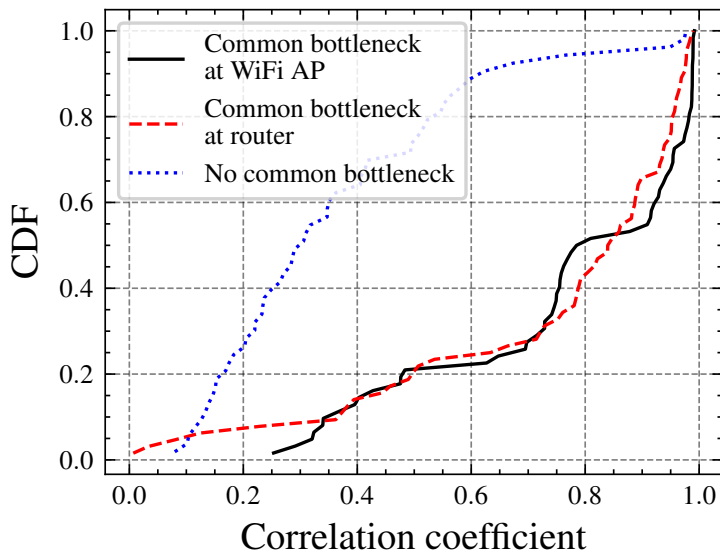


Figure: Common bottleneck

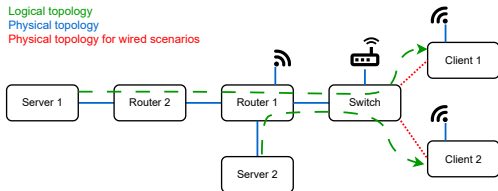
► Correlation: 0.93



CDF graph

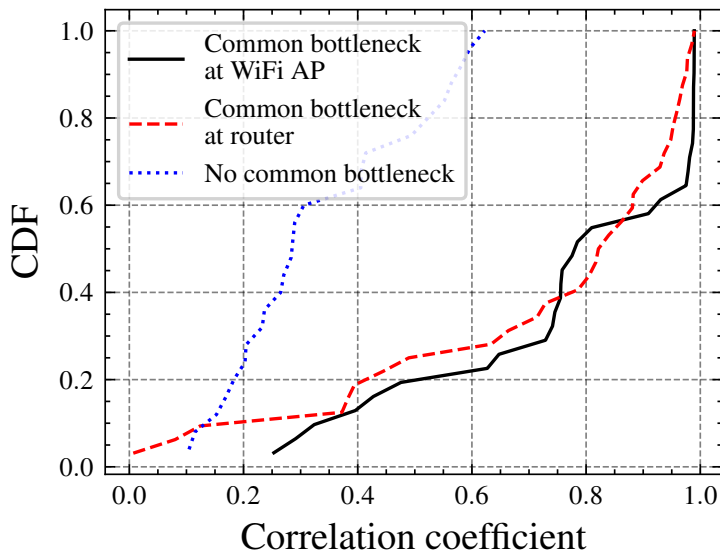


## Traffic types



- ▶ Server 2 → Client 2: Always the same VoIP traffic
- ▶ Server 1 → Client 1:
  - ▶ Three Reno flows
  - ▶ Three Cubic flows
  - ▶ Three BBR flows
  - ▶ One of each
  - ▶ The above, but also with VoIP

# Without VoIP



# Correlation of CDF I

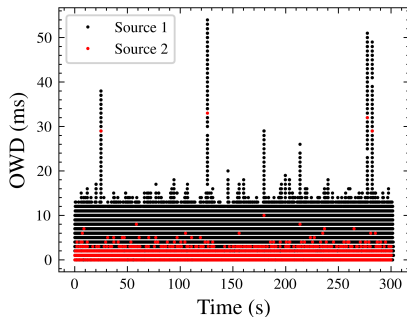


Figure: No common bottleneck

► Correlation: 0.20

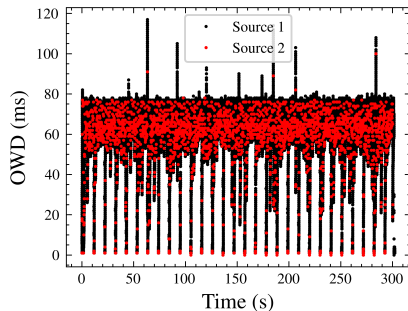


Figure: Common bottleneck

► Correlation: 0.93

# Correlation of CDF II

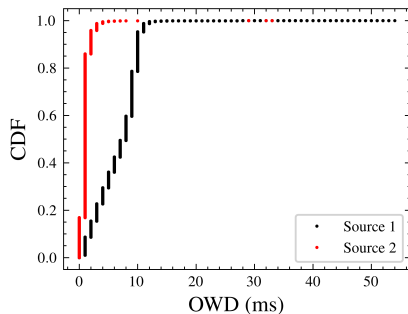


Figure: No common bottleneck

► Correlation: 0.4

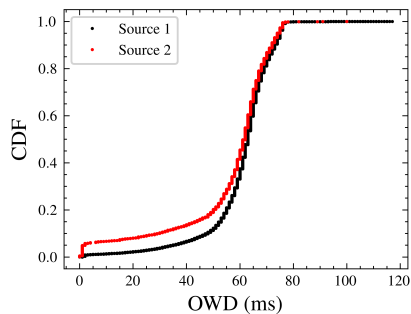


Figure: Common bottleneck

► Correlation: 0.9967

## Correlation of CDF III

