



WHY WAN ACCELERATORS (STILL) MATTER?

Andrea Dainese | Data Center Engineer



festival ICT

6 NOVEMBRE 2014

@ MEDIOLANUM FORUM, ASSAGO (MI)



Segui live l'evento con #festivalICT

Who IS **ANDREA DAINESE?**

- Data Center Engineer @ Cerved Group SpA
- Red Hat RHCE
- VMware VCP-DCV
- NetApp NCIE-SAN
- Cisco CCIE
- Cisco Architecture Design Specialist
- VMware vExpert
- Cisco Champion Data Center
- iou-web and Unified Networking Lab author

Andrea Dainese

> Agenda

1

Introduction

2

The TCP protocol

3

Inter-DC Traffic
Characteristics

4

Key elements
of WAN optimization

5

Optimized WANs
• a real case

6

Designing
a WAAS solution

7

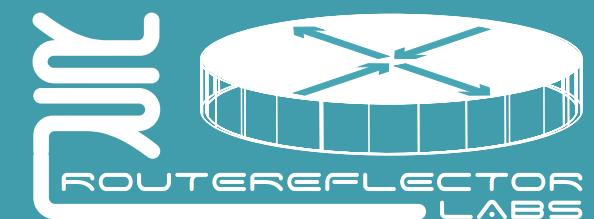
Tips & Tricks

8

Conclusions

- > **1. Introduction**
- > **2. The TCP protocol**
- > **3. Inter-DC Traffic Characteristics**
- > **4. Key elements of WAN optimization**
- > **5. Optimized WANs - a real case**
- > **6. Designing a WAAS solution**
- > **7. Tips & Tricks**
- > **8. Conclusions**

Andrea Dainese



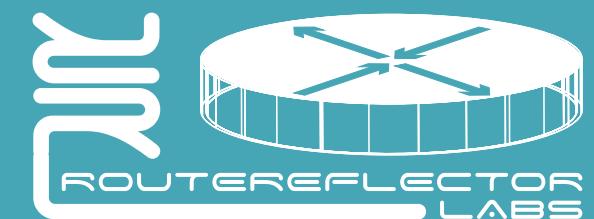
> Introduction

Introduction



- > **1. Introduction**
- > 2. The TCP protocol
- > 3. Inter-DC Traffic Characteristics
- > 4. Key elements of WAN optimization
- > 5. Optimized WANs - a real case
- > 6. Designing a WAAS solution
- > 7. Tips & Tricks
- > 8. Conclusions

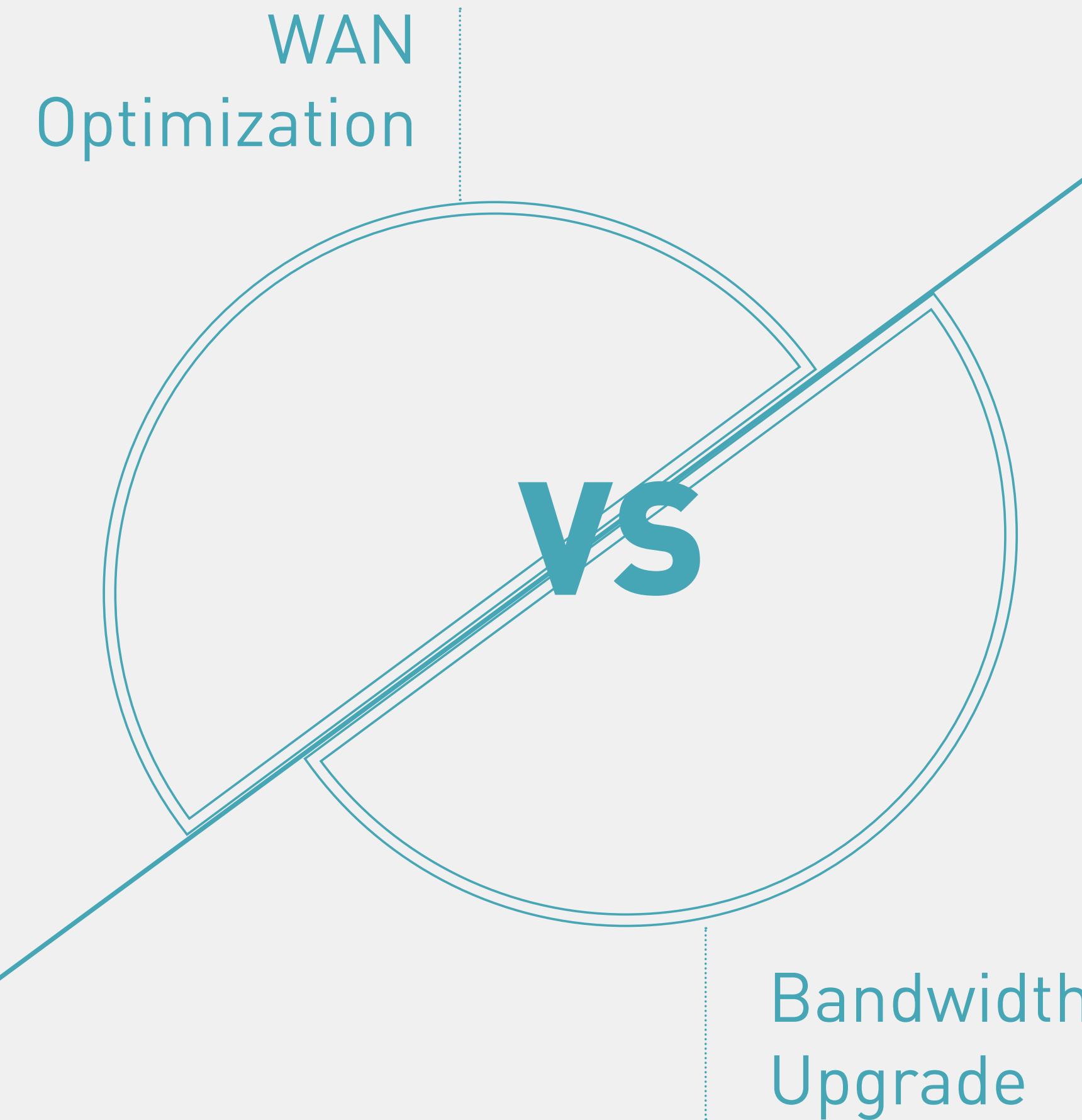
Andrea Dainese



> Introduction

Introduction

- 1 The TCP protocol
- 2 Inter-DC Traffic Characteristics
- 3 Key elements of WAN optimization
- 4 Optimized WANs • a real case
- 5 Designing a WAAS solution
- 6 Tips & Tricks
- 7 Conclusions
- 8



Andrea Dainese

Dark
Fibers



VS

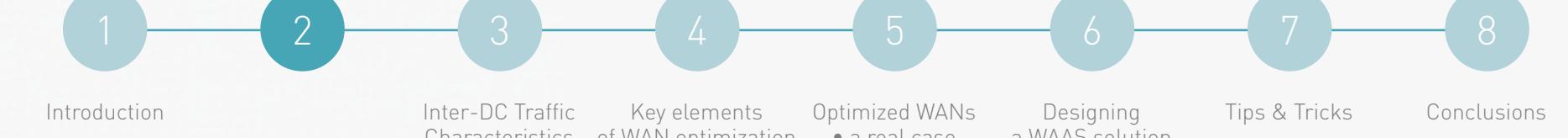
Shared
Lines



Andrea Dainese

> The TCP Protocol

The TCP protocol



- > 1. Introduction
- > **2. The TCP protocol**
- > 3. Inter-DC Traffic Characteristics
- > 4. Key elements of WAN optimization
- > 5. Optimized WANs - a real case
- > 6. Designing a WAAS solution
- > 7. Tips & Tricks
- > 8. Conclusions

Andrea Dainese

> The TCP Protocol

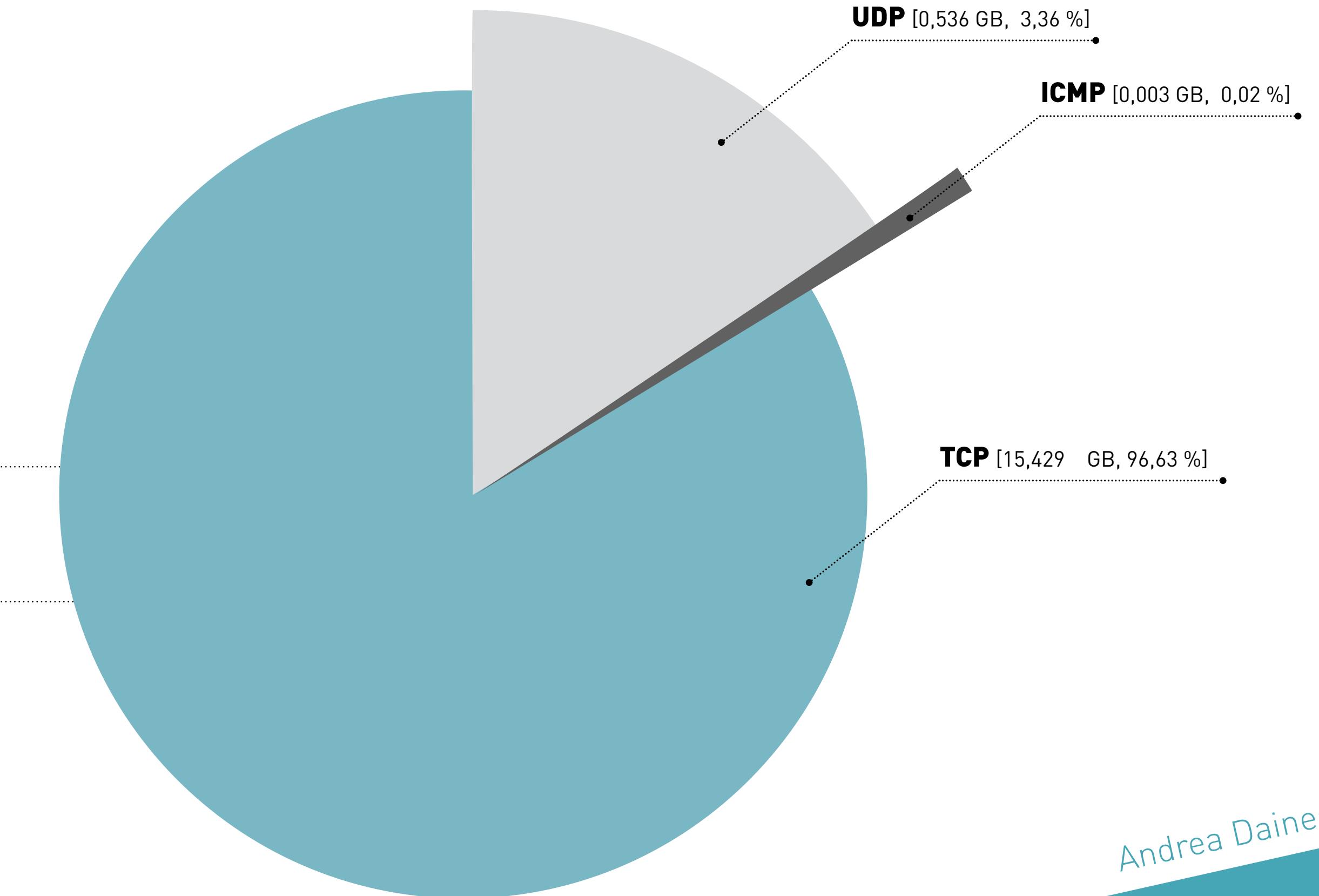
The TCP protocol

- 1 Introduction
- 2 Inter-DC Traffic Characteristics
- 3 Key elements of WAN optimization
- 4 Optimized WANs • a real case
- 5 Designing a WAAS solution
- 6 Tips & Tricks
- 7 Conclusions
- 8

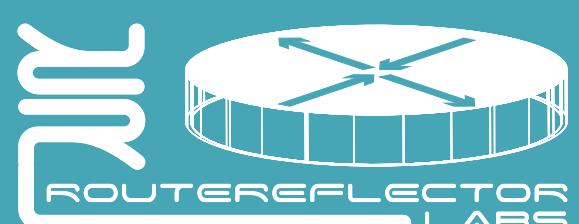
> **TCP** Transmission Control Protocol
> **UDP** User Datagram Protocol
> **ICMP** Internet Control Message Protocol

TRAFFIC (Inbound and Outbound)
Total [15,968 GB]

- **ICMP** [0,003 GB, 0,02 %]
- **TCP** [15,429 GB, 96,63 %]
- **UDP** [0,536 GB, 3,36 %]



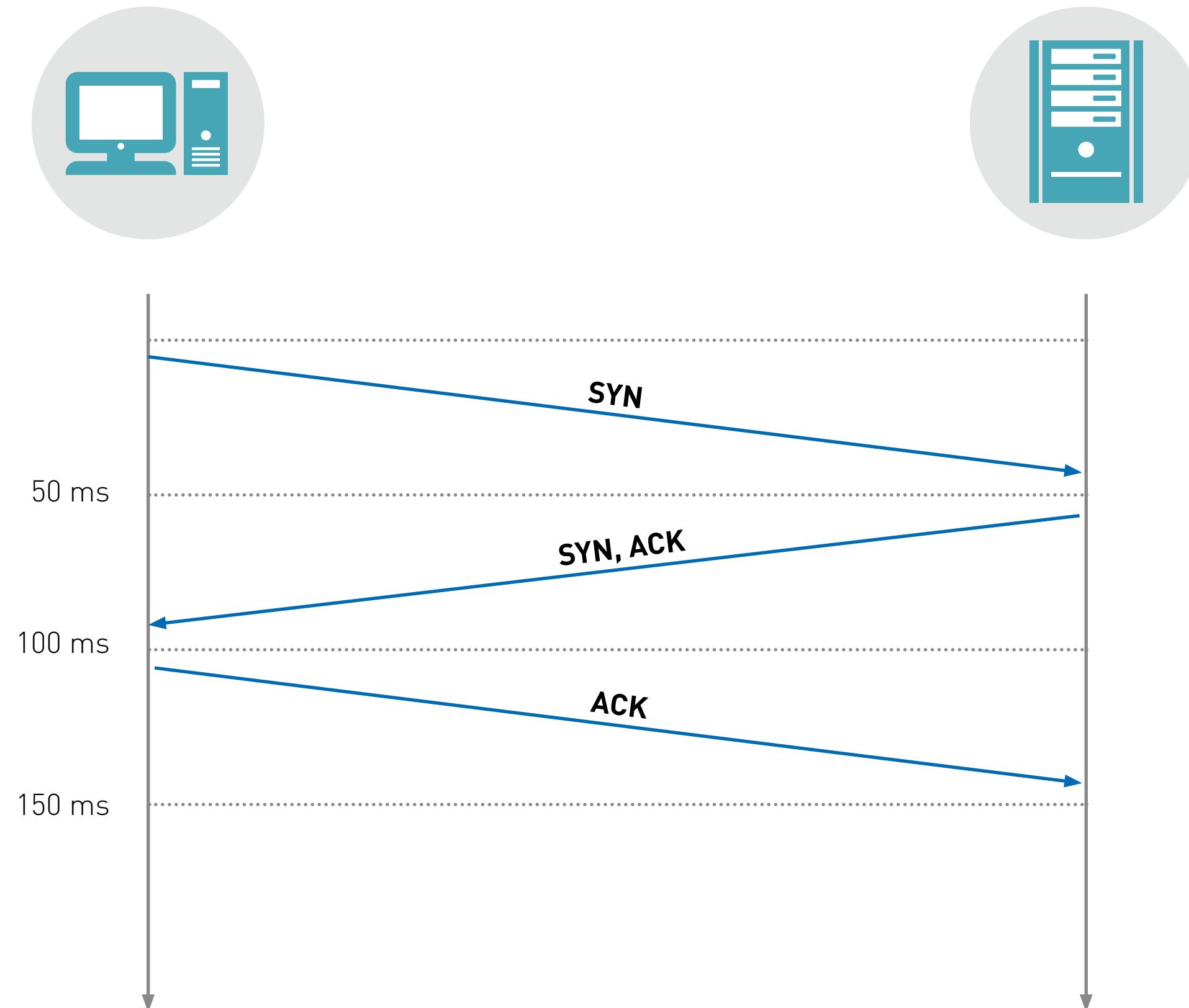
Andrea Dainese



> TCP • Handshake

TCP • Handshake

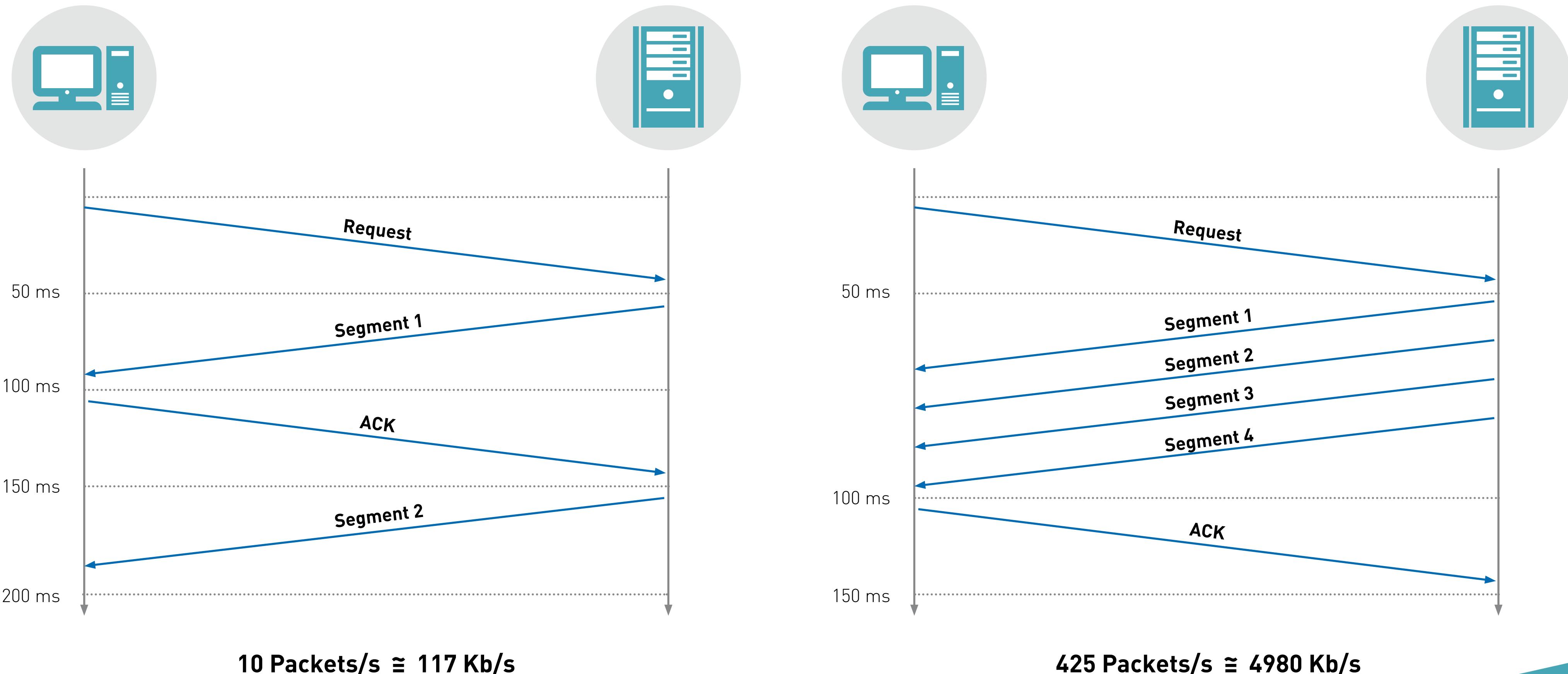
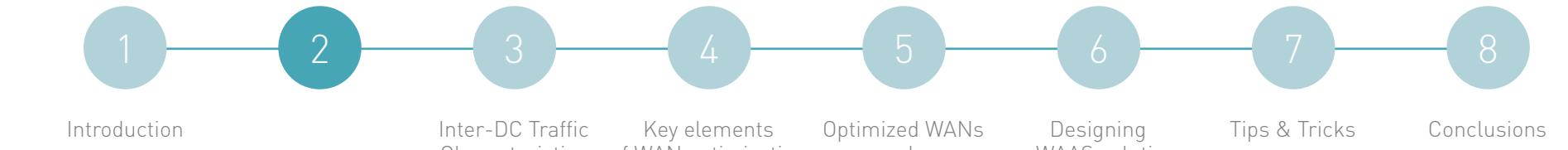
- 1 Introduction
- 2 Inter-DC Traffic Characteristics
- 3 Key elements of WAN optimization
- 4 Optimized WANs • a real case
- 5 Designing a WAAS solution
- 6 Tips & Tricks
- 7 Conclusions
- 8



Andrea Dainese

> TCP • Windowing

TCP • Windowing



> TCP • Selective Acknowledge

TCP • Selective Acknowledge

1

Introduction

2

Inter-DC Traffic
Characteristics

3

Key elements
of WAN optimization
• a real case

4

Optimized WANs

5

Designing
a WAAS solution

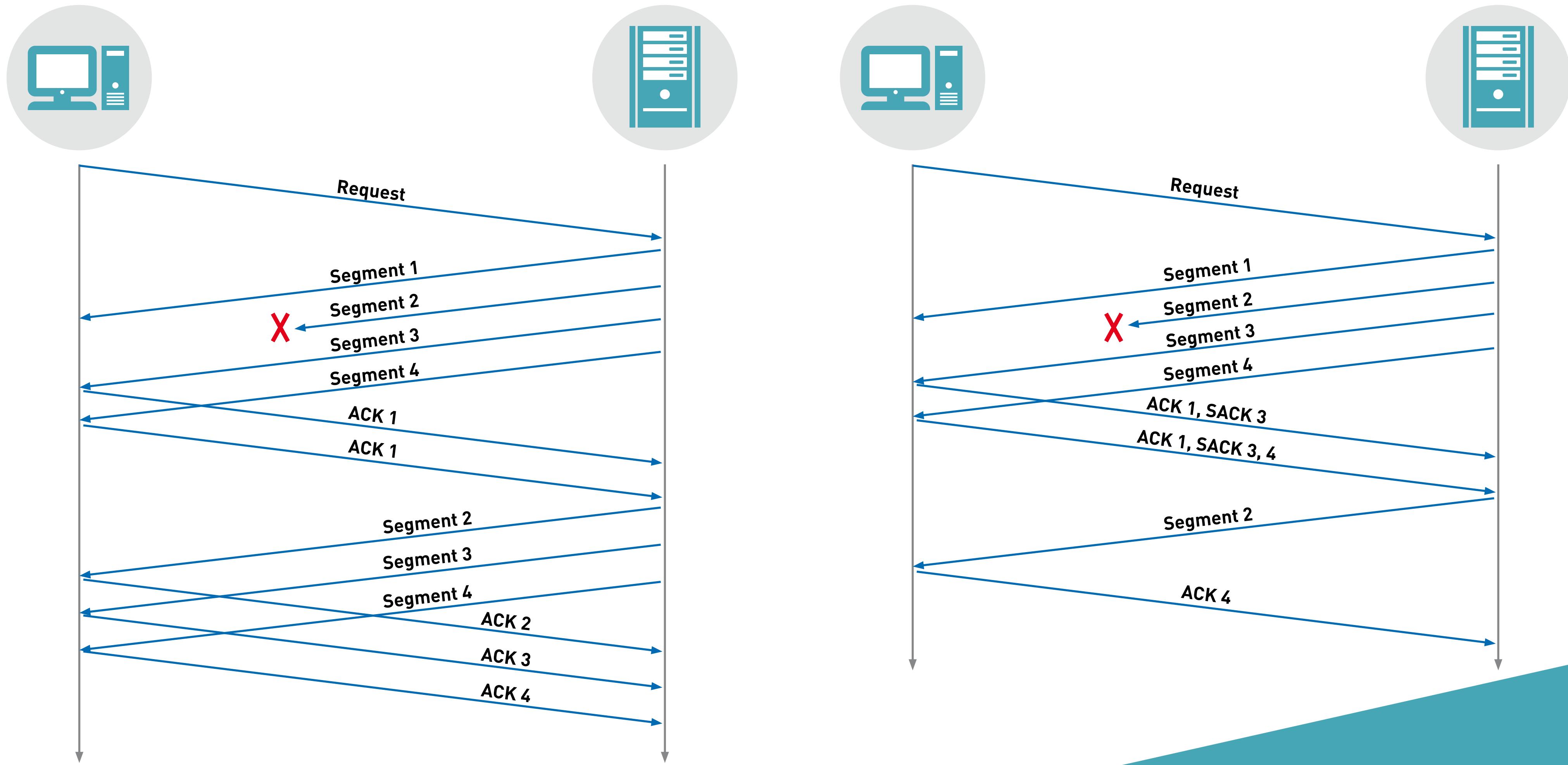
6

Tips & Tricks

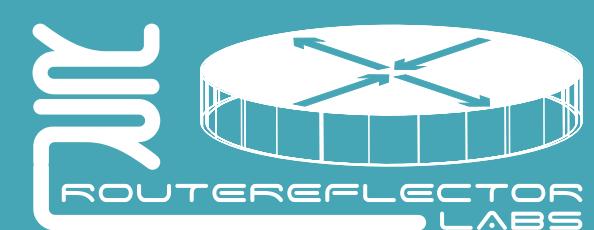
7

Conclusions

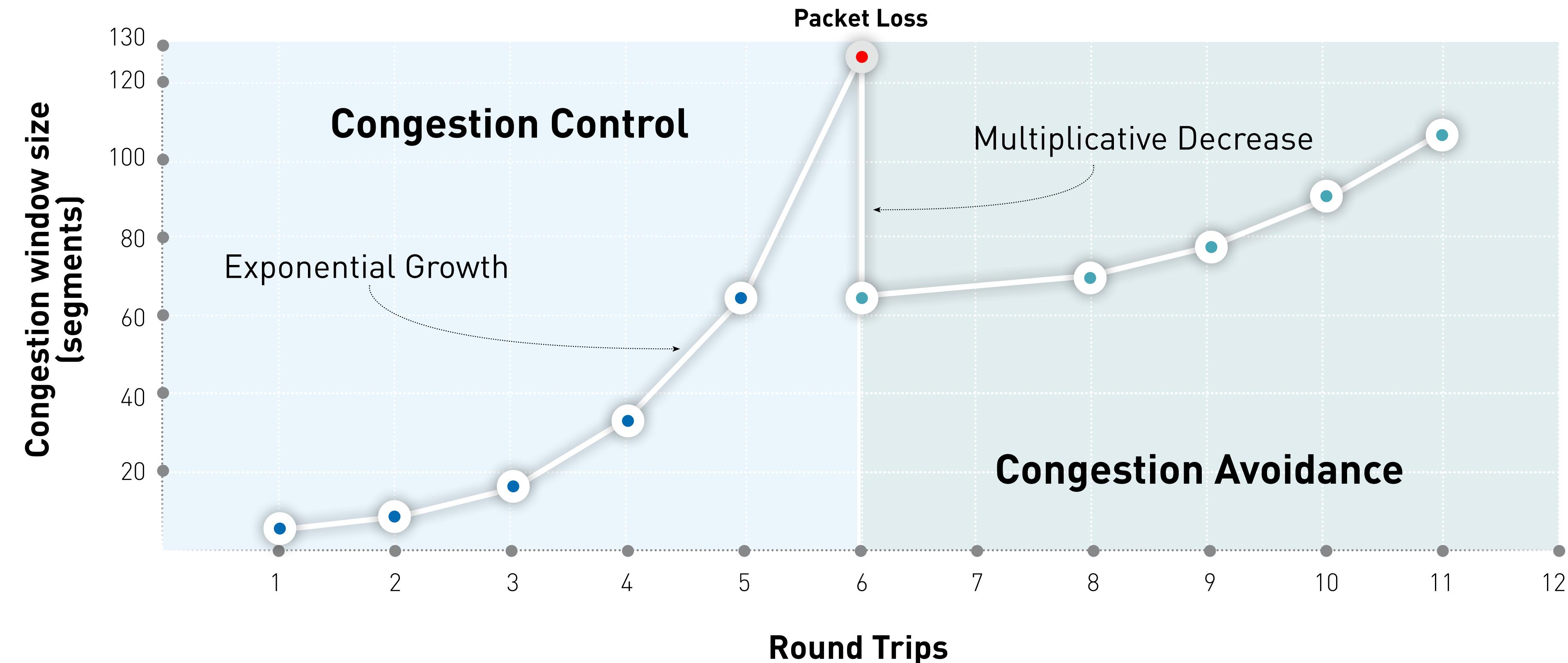
8



Andrea Dainese



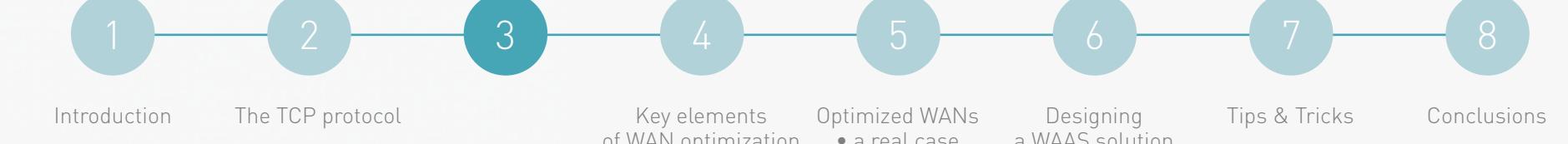
V TCP • Slow start



Andrea Dainese

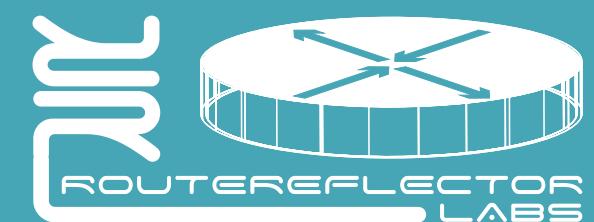
> Inter-DC Traffic Characteristics

Inter-DC Traffic Characteristics



- > 1. Introduction
- > 2. The TCP protocol
- > **3. Inter-DC Traffic Characteristics**
- > 4. Key elements of WAN optimization
- > 5. Optimized WANs - a real case
- > 6. Designing a WAAS solution
- > 7. Tips & Tricks
- > 8. Conclusions

Andrea Dainese



> Inter-DC Traffic

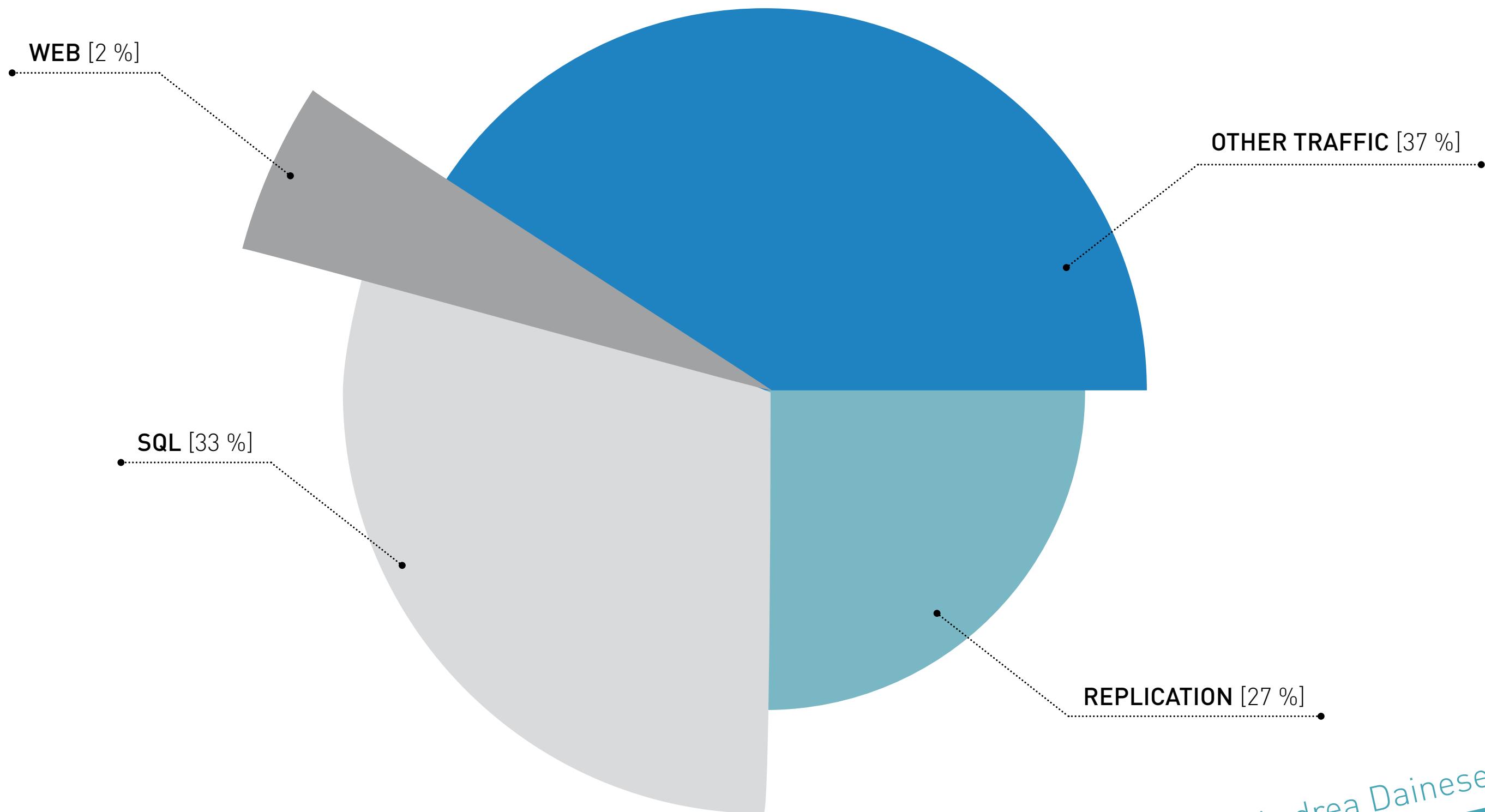
Inter-DC Traffic Characteristics

- 1 Introduction
- 2 The TCP protocol
- 3 Key elements of WAN optimization
- 4 Optimized WANs • a real case
- 5 Designing a WAAS solution
- 6 Designing a WAAS solution
- 7 Tips & Tricks
- 8 Conclusions

> **Replication:** 27%

> **SQL:** 33%

> **Other Traffic (CIFS, e-mail, FTP, ...):** 37%



- **OTHER TRAFFIC** [37 %]
- **WEB** [2 %]
- **SQL** [33 %]
- **REPLICATION** [27 %]

Andrea Dainese

> Inter-DC Traffic

Inter-DC Traffic **CHARACT ERISTICS**

Inter-DC Traffic Characteristics



NetApp SnapMirror

- > Uncompressed
- > Unencrypted

Oracle SQL

- > Uncompressed
- > Unencrypted

FTP

Andrea Dainese

> Inter-DC Traffic

Inter-DC Traffic **CHARACT ERISTICS**

- **NetApp SnapMirror**
 - > Uncompressed
 - > Unencrypted
 - **Oracle SQL**
 - > Uncompressed
 - > Unencrypted
 - **FTP**
- Unoptimized!**

Inter-DC Traffic Characteristics

1

2

3

4

5

6

7

8

Introduction

The TCP protocol

Key elements of WAN optimization
• a real case

Optimized WANs
Designing a WAAS solution

Tips & Tricks

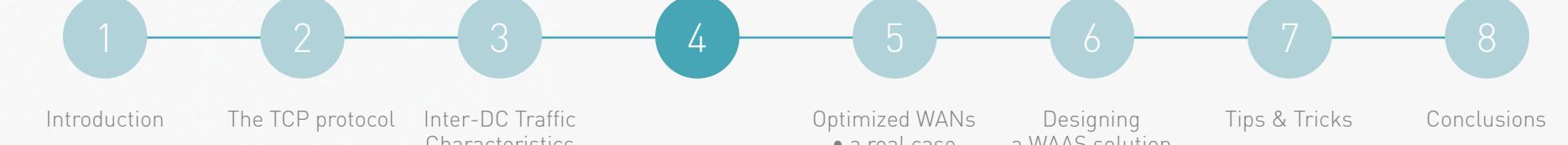
Conclusions

Andrea Dainese



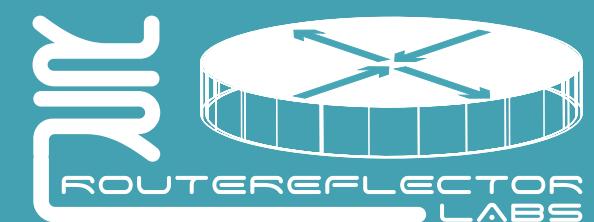
> Key elements of WAN optimization

Key elements of WAN optimization



- > 1. Introduction
- > 2. The TCP protocol
- > 3. Inter-DC Traffic Characteristics
- > **4. Key elements of WAN optimization**
- > 5. Optimized WANs - a real case
- > 6. Designing a WAAS solution
- > 7. Tips & Tricks
- > 8. Conclusions

Andrea Dainese



> WAN optimization: key elements

Key elements of WAN optimization

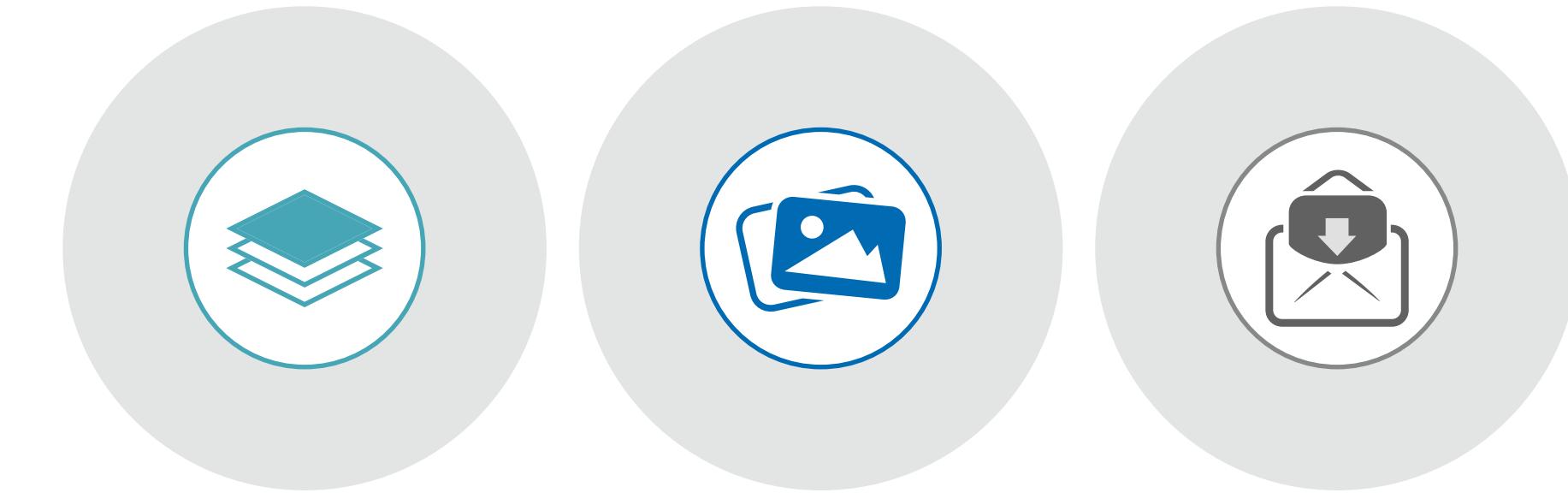
- 1 Introduction
- 2 The TCP protocol
- 3 Inter-DC Traffic Characteristics
- 4 Optimized WANs
 - a real case
- 5 Designing a WAAS solution
- 6 Tips & Tricks
- 7 Conclusions
- 8

> Data deduplication

DATA



DEDUPLICATION



Andrea Dainese

> WAN optimization: key elements

Key elements of WAN optimization

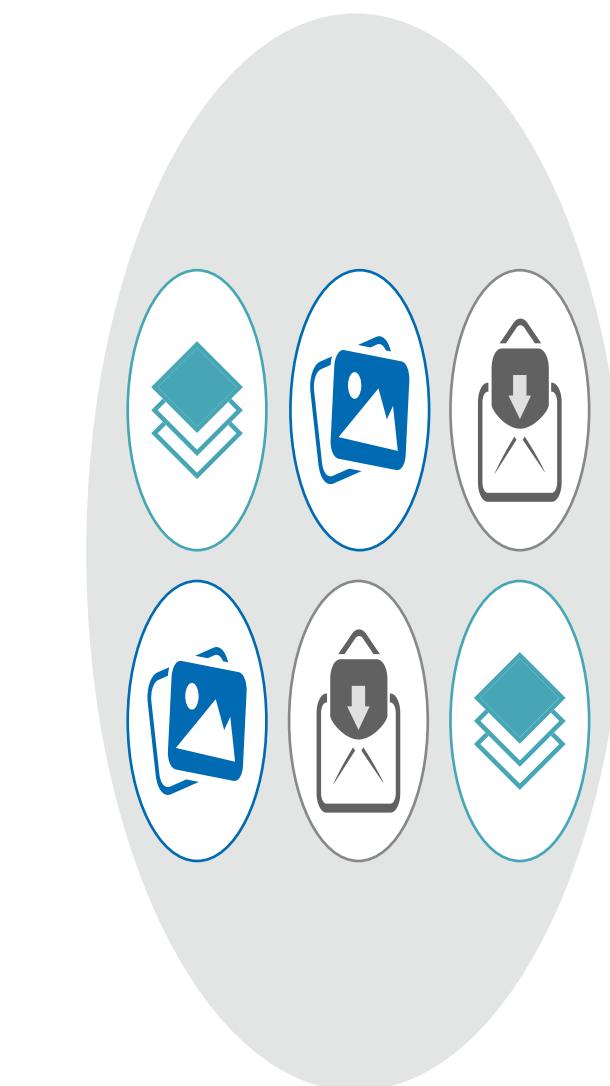
- 1 Introduction
- 2 The TCP protocol
- 3 Inter-DC Traffic Characteristics
- 4 Optimized WANs
 - a real case
- 5 Designing a WAAS solution
- 6 Tips & Tricks
- 7 Conclusions
- 8

> Data compression

DATA



COMPRESSION

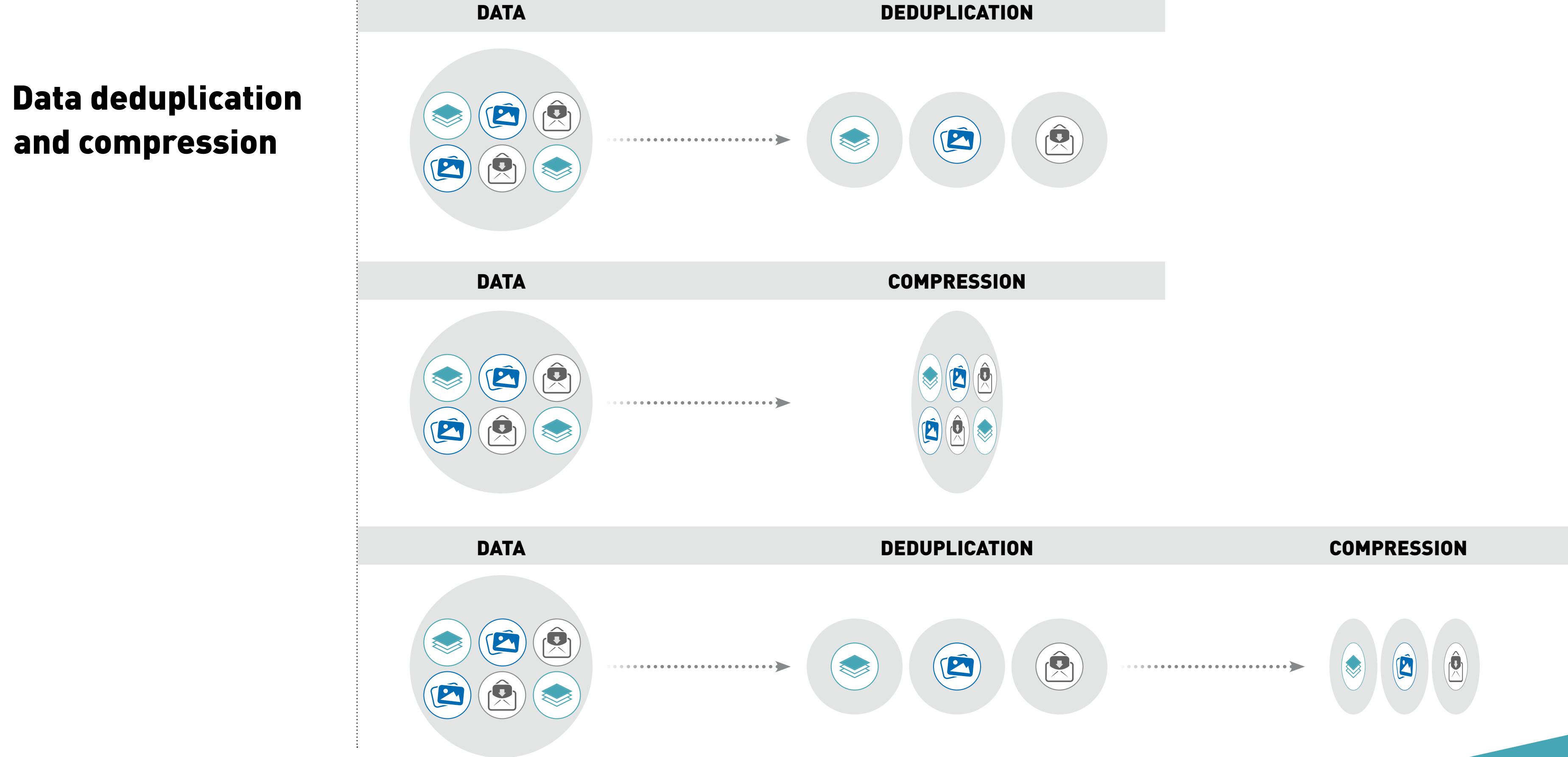


Andrea Dainese

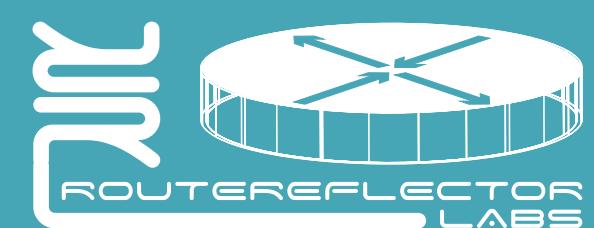
> WAN optimization: key elements

Key elements
of WAN optimization

- 1 Introduction
- 2 The TCP protocol
- 3 Inter-DC Traffic Characteristics
- 4 Optimized WANs
 - a real case
- 5 Designing a WAAS solution
- 6 Tips & Tricks
- 7 Conclusions
- 8



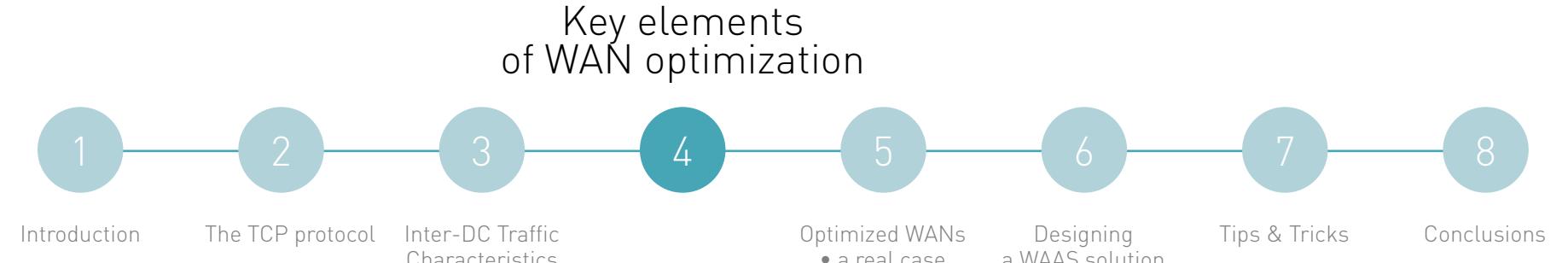
Andrea Dainese



TCP optimization

TCP optimization

- > Large initial windows
- > Window scaling
- > Advanced congestion avoidance
- > Selective Acknowledgement
- > Large buffer

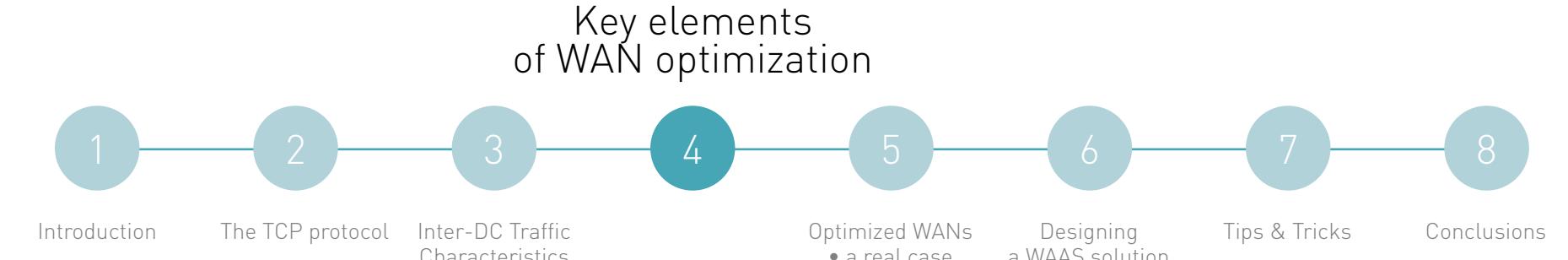


Andrea Dainese

TCP Applications

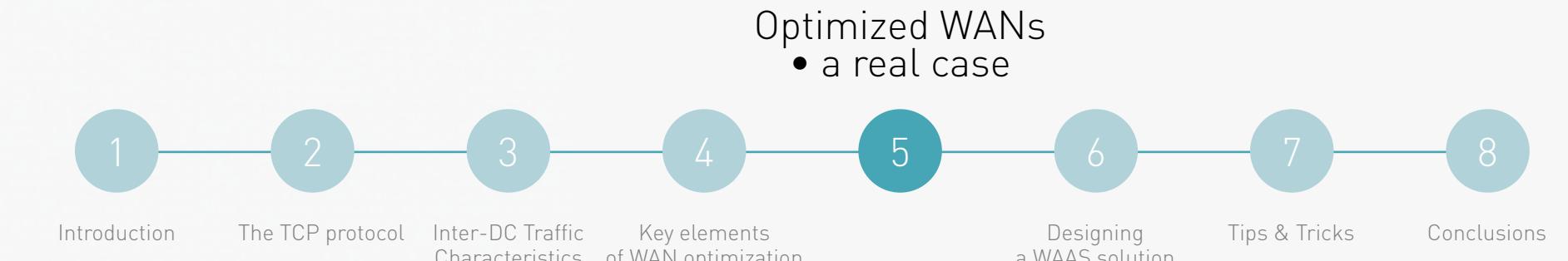
Applications

- > Object caching
- > Local response handling
- > Prepositioning
- > Read-ahead
- > Write-behind



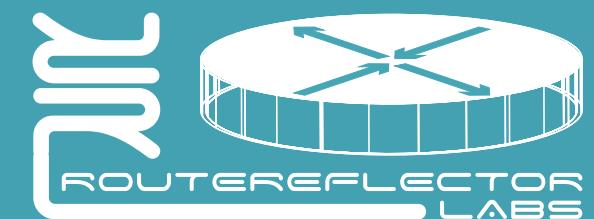
Andrea Dainese

> Optimized WANs • a real case

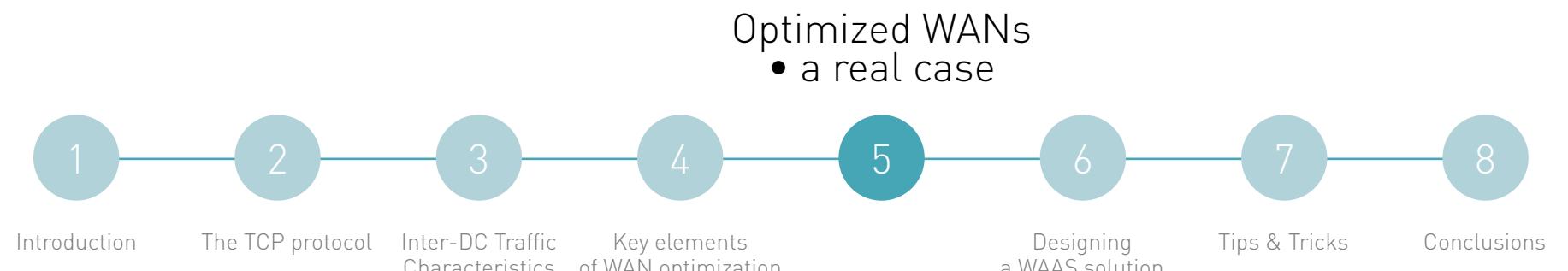


- > 1. Introduction
- > 2. The TCP protocol
- > 3. Inter-DC Traffic Characteristics
- > 4. Key elements of WAN optimization
- > **5. Optimized WANs - a real case**
- > 6. Designing a WAAS solution
- > 7. Tips & Tricks
- > 8. Conclusions

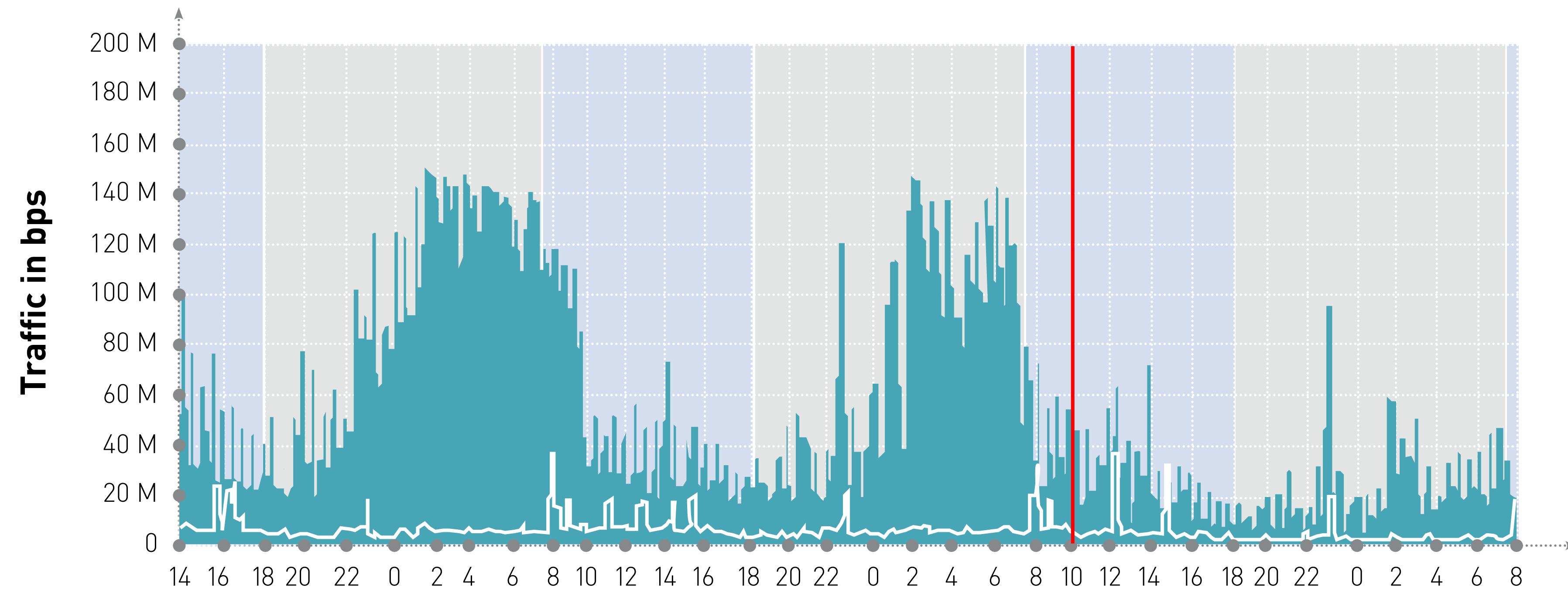
Andrea Dainese



> Optimized WANs • a real case

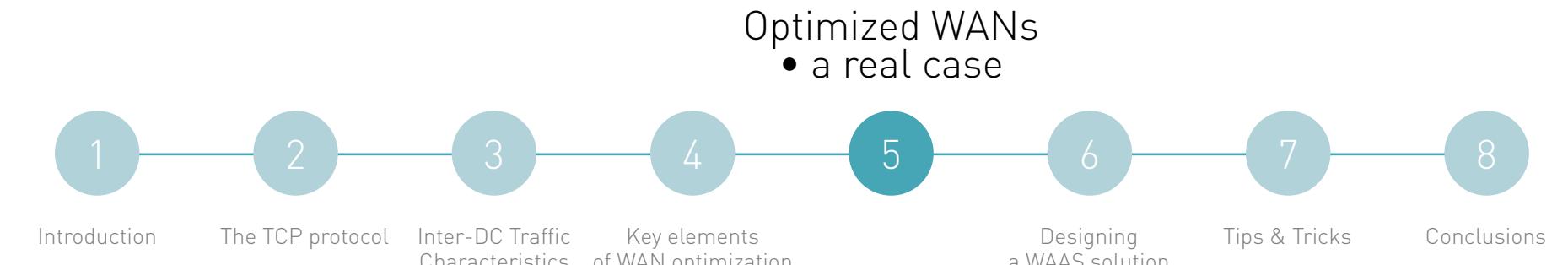


> Before and after



Andrea Dainese

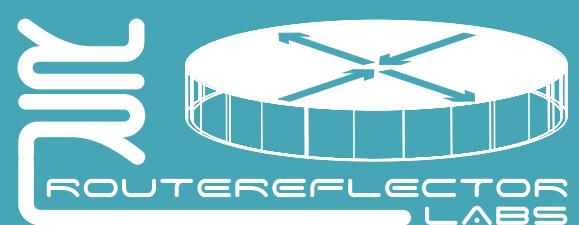
> Optimized WANs • a real case



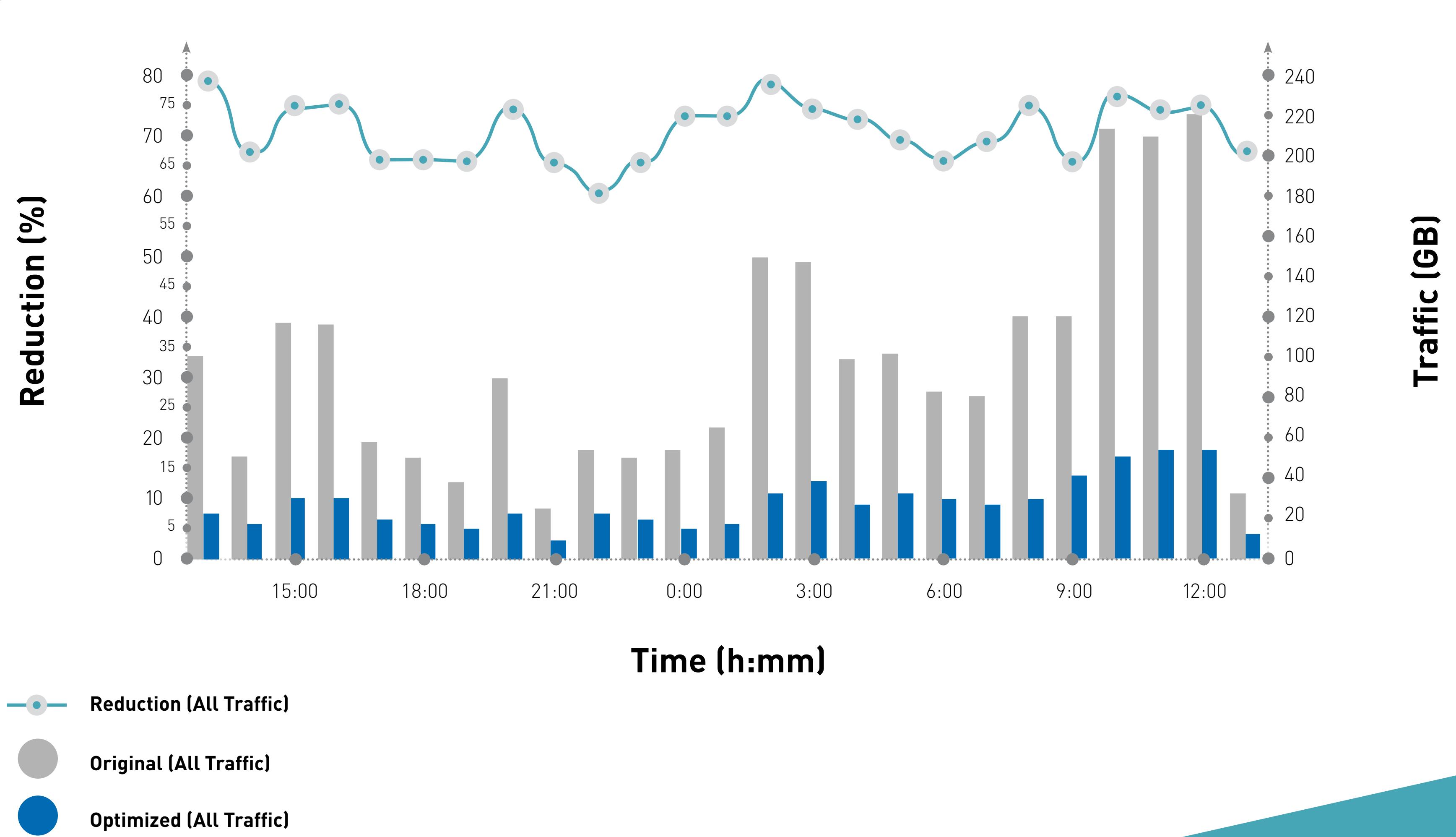
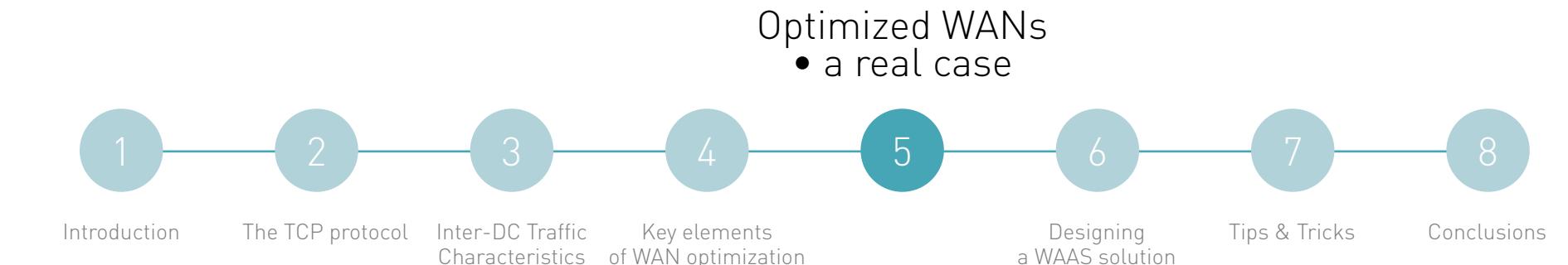
> Before and after

	Before	After	Reduction
Total	46.0 TB	13.9 TB	70 %
Replication	11.8 TB	2.9 TB	75 %
SQL	14.2 TB	4 TB	71 %
FTP (Other)	17 TB	5 TB	70 %

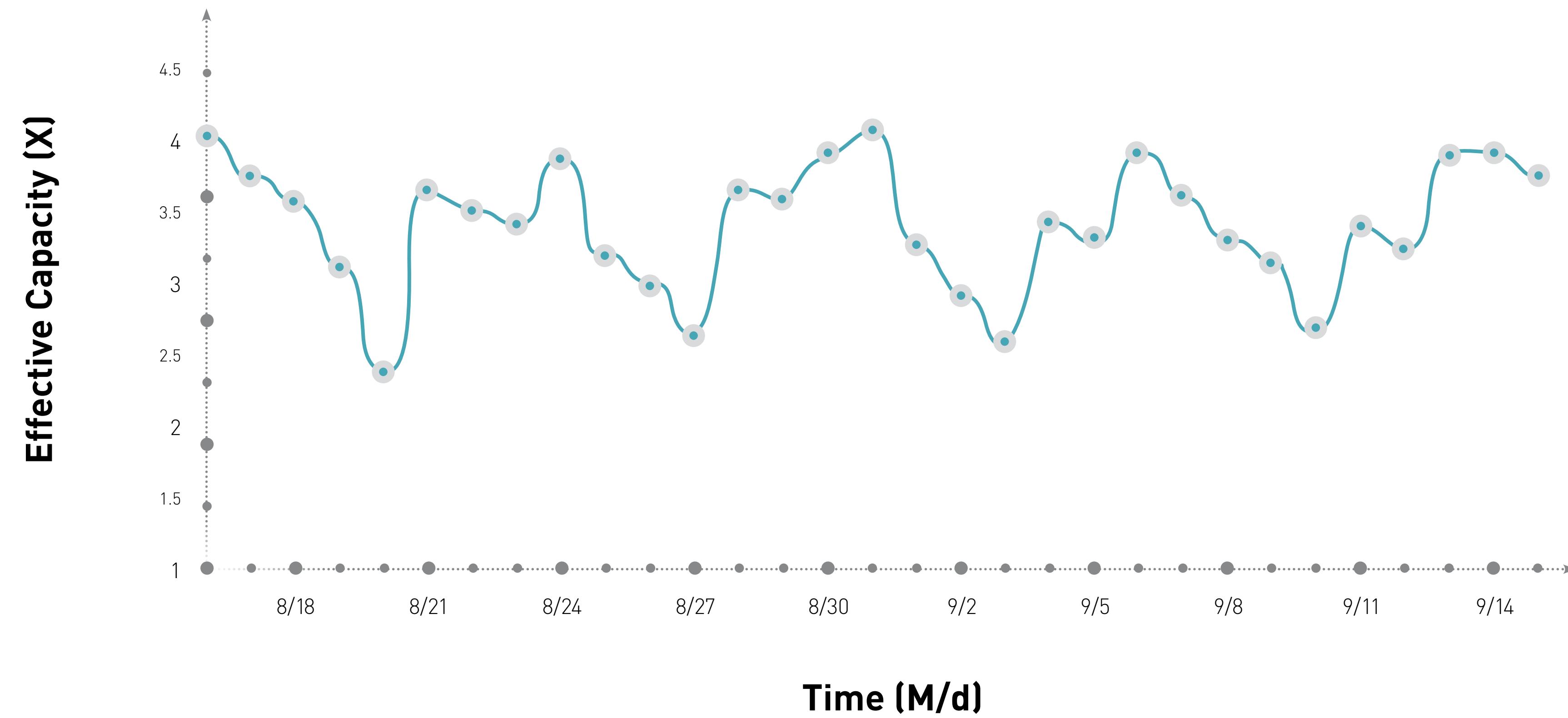
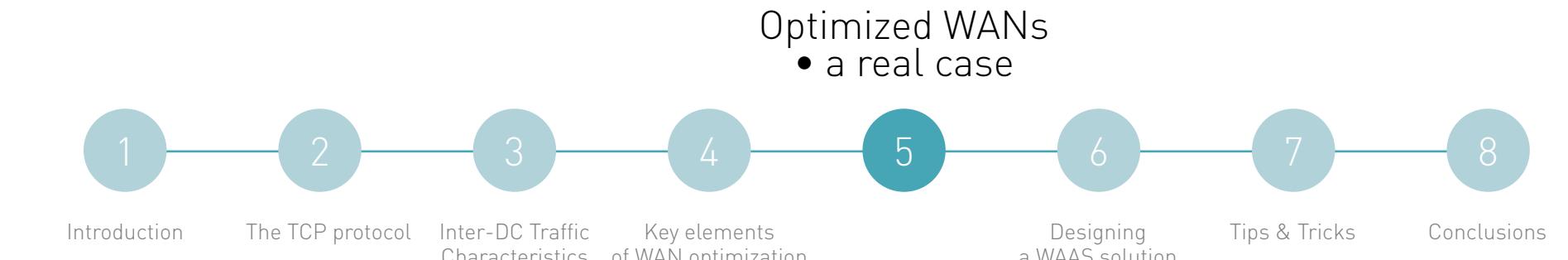
Andrea Dainese



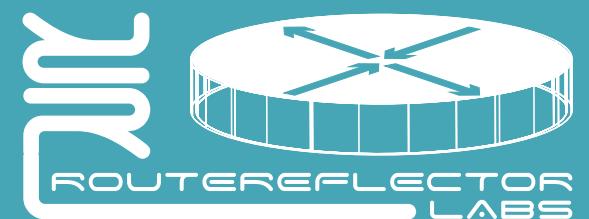
V Optimized WANs • a real case



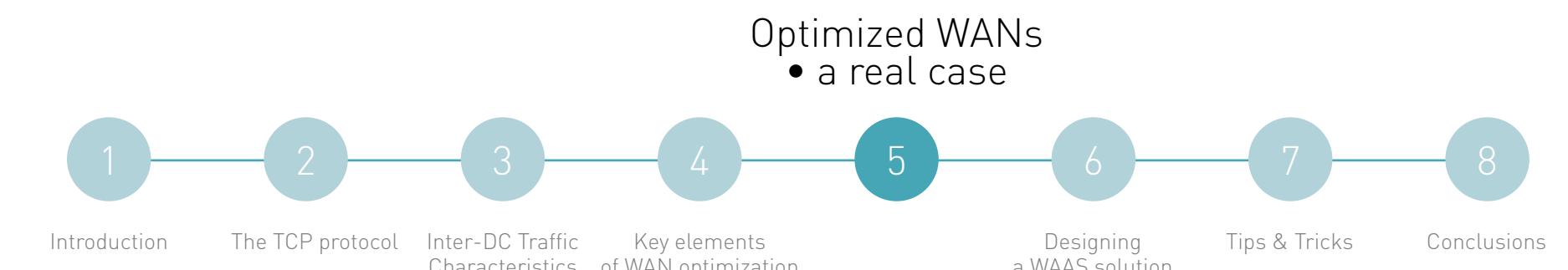
V Optimized WANs • a real case



Andrea Dainese



> Optimized WANs • a real case

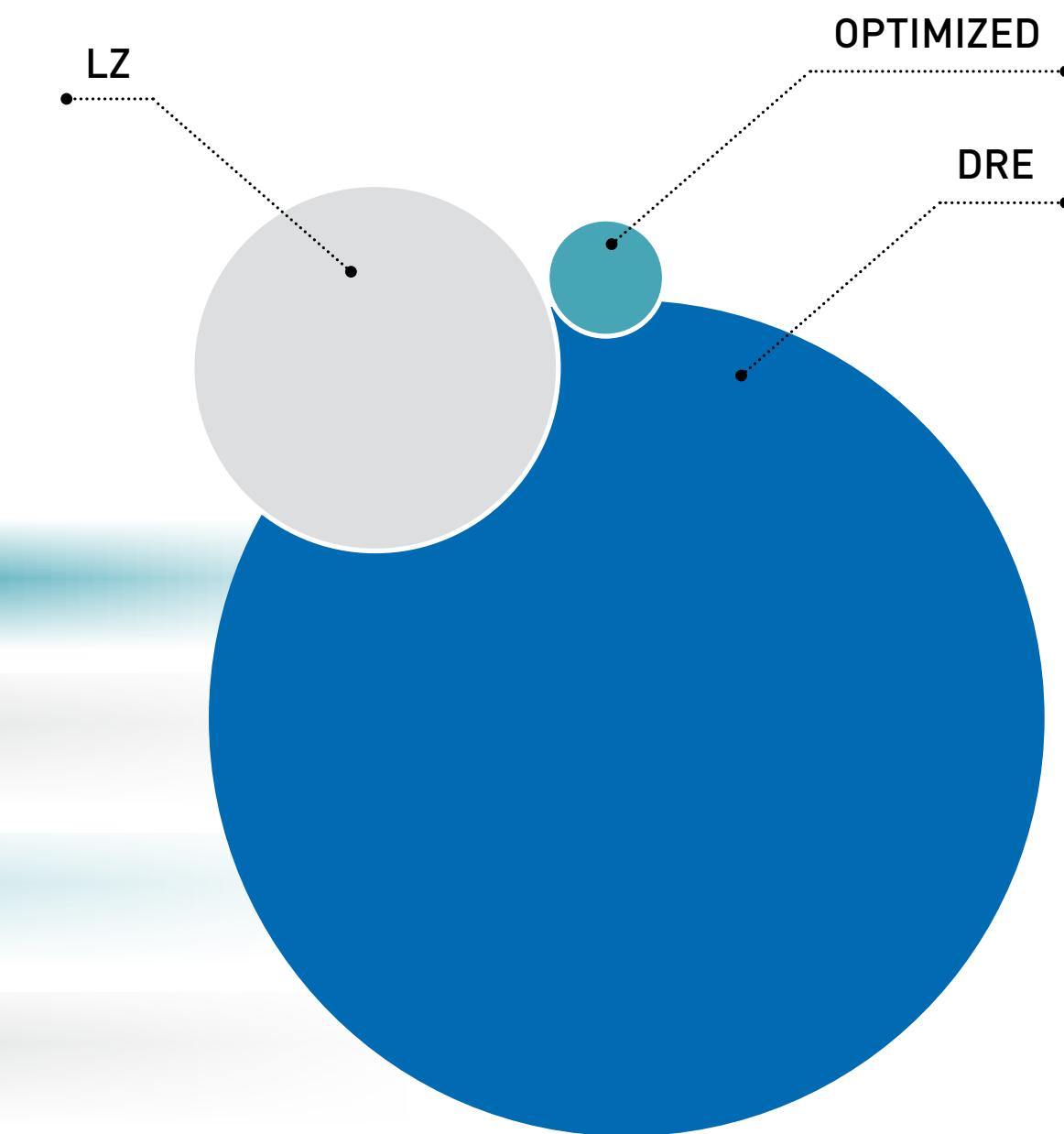


> **TFO, DRE, LZ**

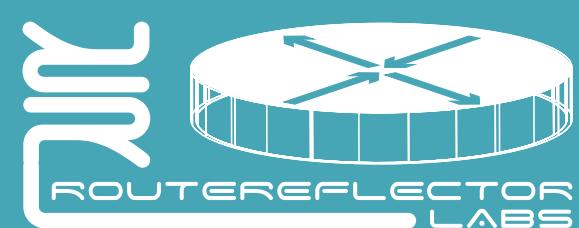
- Transfer
- DRE
- LZ

	Original	Optimized	Reduction
Transfer	725 MB	25 MB	96 %
DRE	725 MB	92 MB	87 %
LZ	92 MB	25 MB	73 %

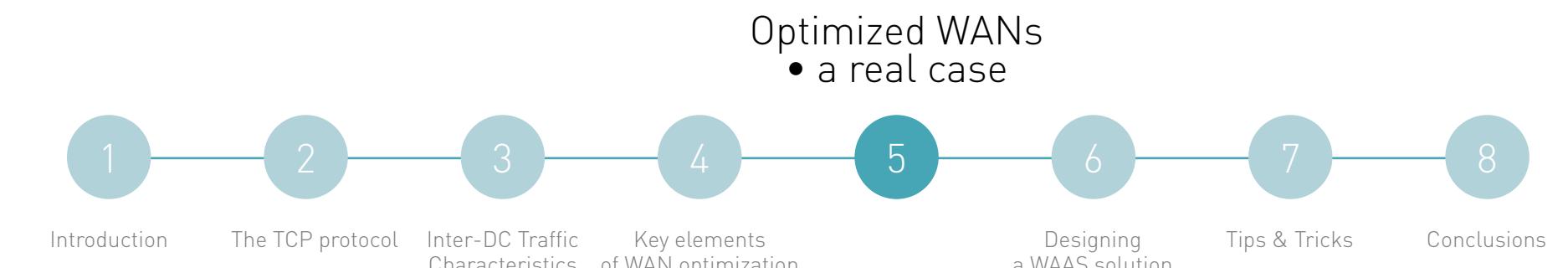
- DRE
- OPTIMIZED
- LZ



Andrea Dainese



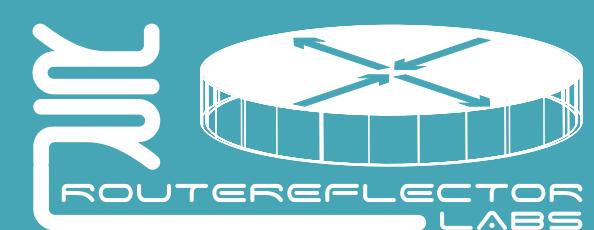
> Optimized WANs • A real case



> TFO, DRE, LZ

```
#show statistics connection conn-id 590048
[...]
-----
Open at 09/04/2014 10:40:37, Still active
Encode:
Overall: msg: 329, in: 622 KB, out: 93133 B, ratio: 85.40%
DRE: msg: 329, in: 622 KB, out: 326 KB, ratio: 47.51%
LZ: msg: 313, in: 326 KB, out: 92666 B, ratio: 72.28%
Avg latency: 0.245 ms, Avg msg size: 1938 B
Message size distribution:
0-1K=52% 1K-5K=40% 5K-15K=6% 15K-25K=1% 25K-40K=0% >40K=0%
Decode:
Overall: msg: 245, in: 13459 B, out: 64159 B, ratio: 79.02%
DRE: msg: 245, in: 63431 B, out: 64159 B, ratio: 1.13%
LZ: msg: 227, in: 13099 B, out: 63071 B, ratio: 79.23%
Avg latency: 0.035 ms, Avg msg size: 261 B
Message size distribution:
0-1K=97% 1K-5K=2% 5K-15K=0% 15K-25K=0% 25K-40K=0% >40K=0%
```

Andrea Dainese

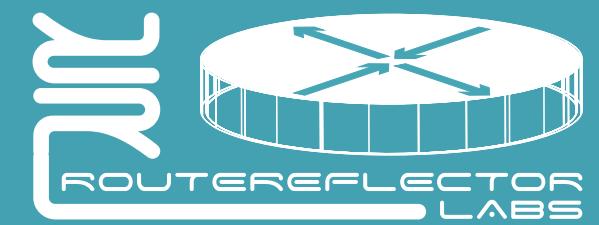


> Designing a WAAS solution



- > 1. Introduction
- > 2. The TCP protocol
- > 3. Inter-DC Traffic Characteristics
- > 4. Key elements of WAN optimization
- > 5. Optimized WANs - a real case
- > **6. Designing a WAAS solution**
- > 7. Tips & Tricks
- > 8. Conclusions

Andrea Dainese



Components of a **WAAS** solutions

> Components of a WAAS solution

Designing a WAAS solution

- 1 Introduction
- 2 The TCP protocol
- 3 Inter-DC Traffic Characteristics
- 4 Key elements of WAN optimization
- 5 Optimized WANs • a real case
- 6
- 7 Tips & Tricks
- 8 Conclusions



WAVE Appliance: <http://goo.gl/cQEGJp>

- > up to 150000 TCP connection, 96GB RAM, 4.2TB
- > up to 6 virtual blades for installation



WAAS for ISR: <http://goo.gl/51Eyq8>



vWAAS: <http://goo.gl/8cXWfE>

- > up to 50000? TCP connection, 8vCPU, 48GB RAM



WAAS Mobile: <http://goo.gl/ZhW9cn>



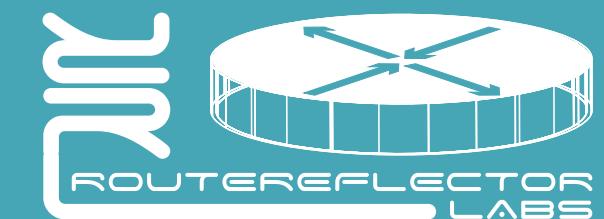
WAAS Express: <http://goo.gl/UjpfTv>

- > up to 400 TCP connection, 10Mbps, 4GB RAM
- > fully integrated into IOS, ISR G2 series



CM/vCM

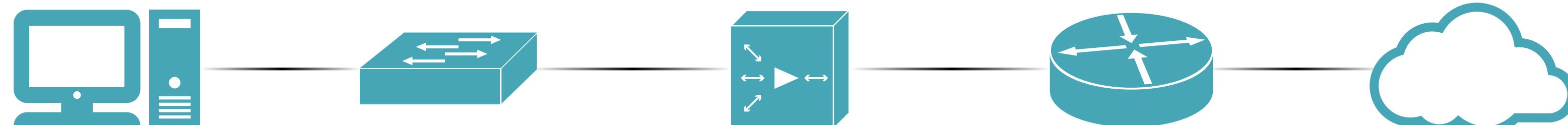
Andrea Dainese



> Designing a WAAS solution

> **Inline**

Layer 2



Cisco WAE

WAN

Layer 3



WAN

Andrea Dainese

> Designing a WAAS solution

1

Introduction

2

The TCP protocol

3

Inter-DC Traffic
Characteristics

4

Key elements
of WAN optimization
• a real case

5

Optimized WANs

6

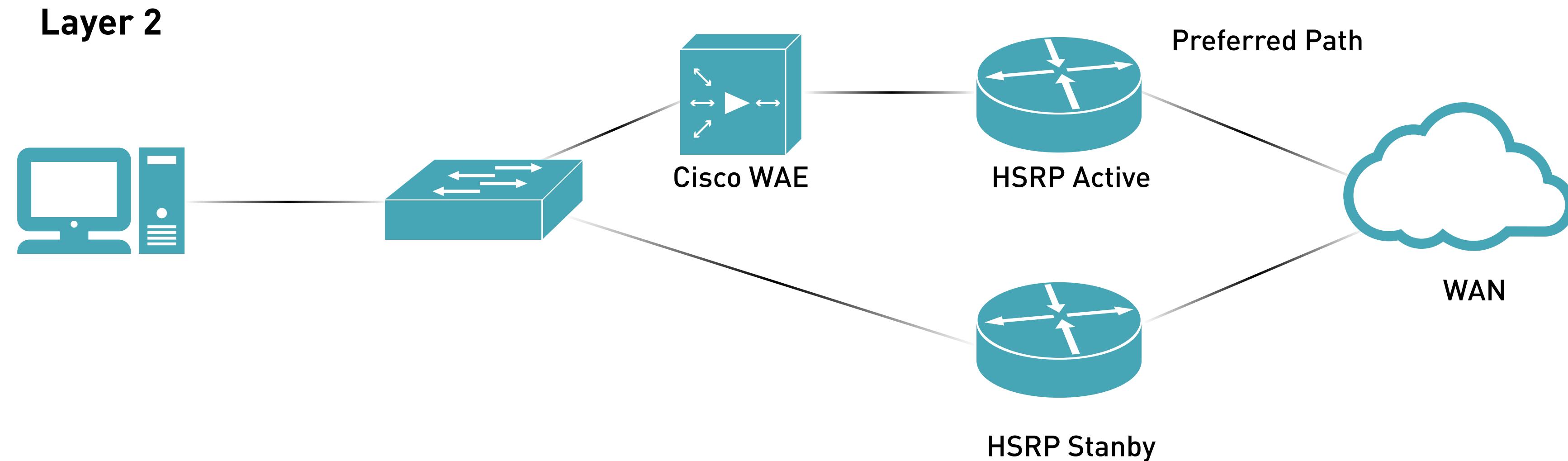
Tips & Tricks

7

Conclusions

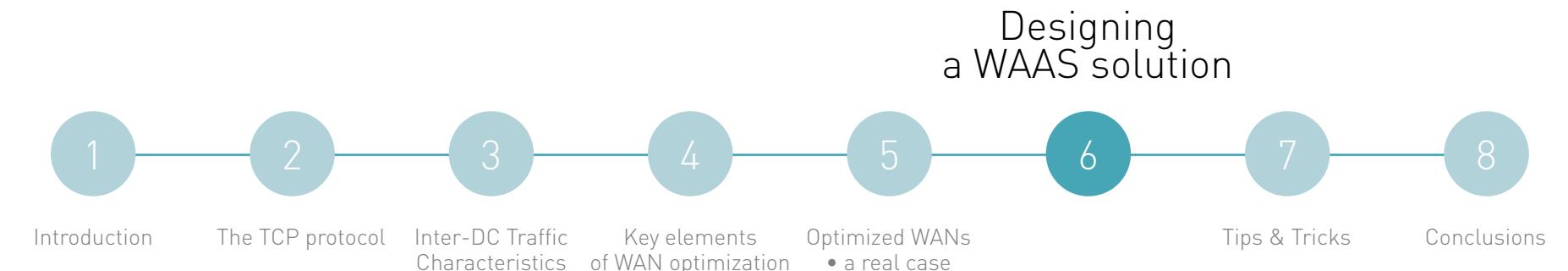
Designing
a WAAS solution

> **Inline (with HA reachability)**

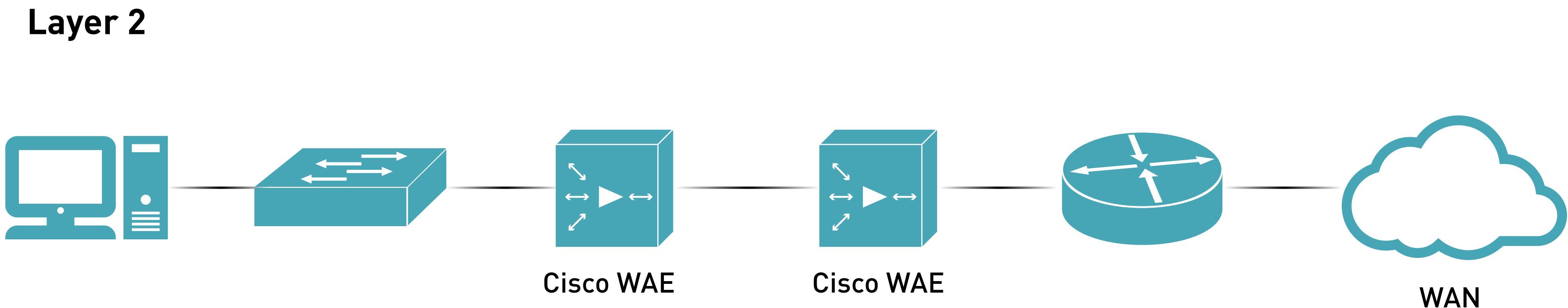


Andrea Dainese

> Designing a WAAS solution



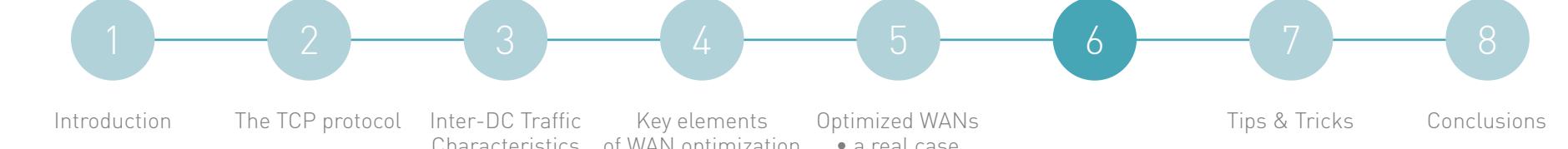
> **Inline (with HA)**



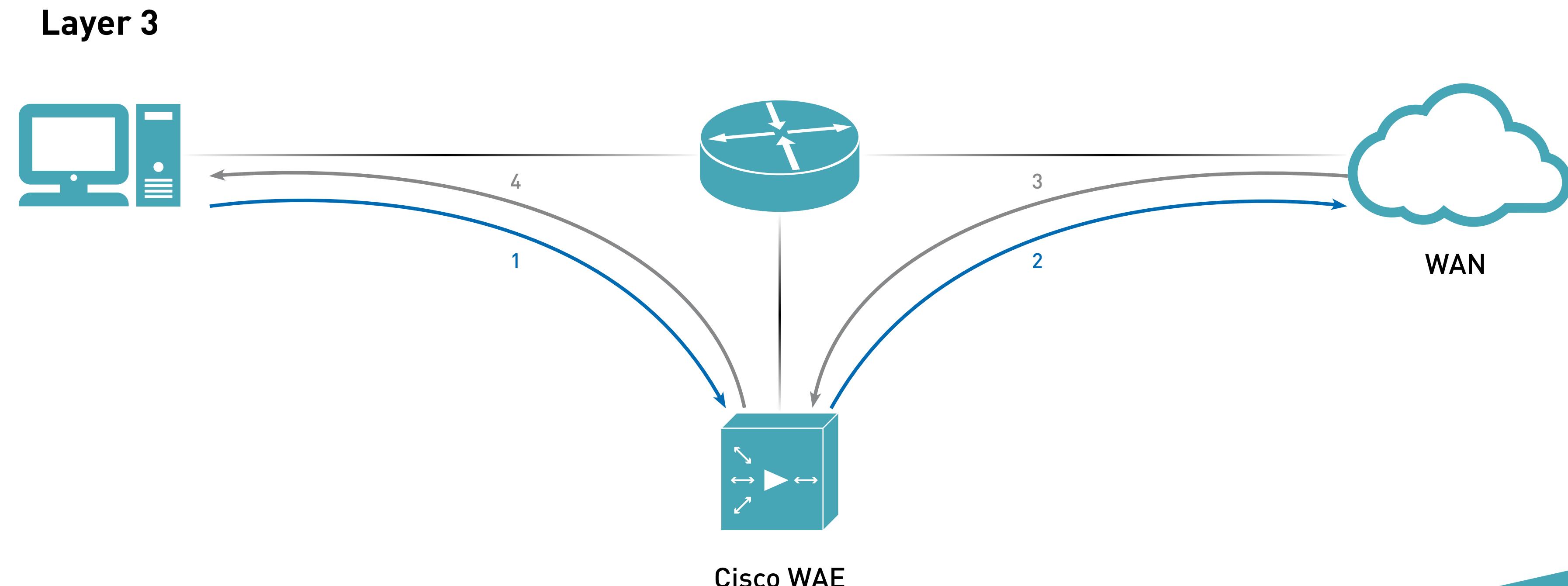
Andrea Dainese



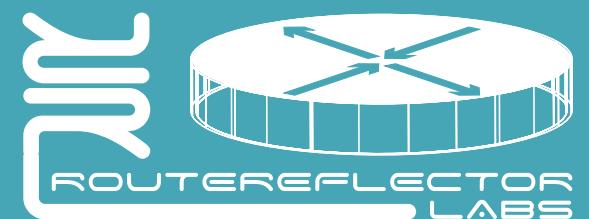
> Designing a WAAS solution



> WCCP



Andrea Dainese



> Designing a WAAS solution

1

Introduction

2

The TCP protocol

3

Inter-DC Traffic
Characteristics

4

Key elements
of WAN optimization

5

Optimized WANs
• a real case

6

Tips & Tricks

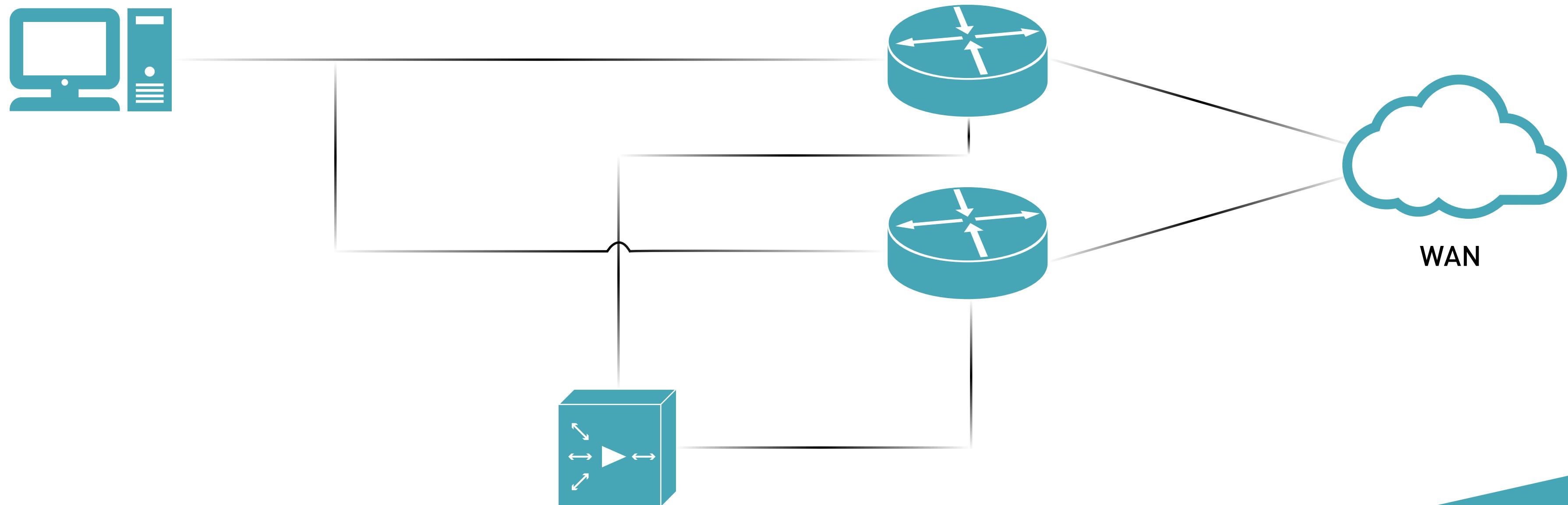
7

Conclusions

Designing
a WAAS solution

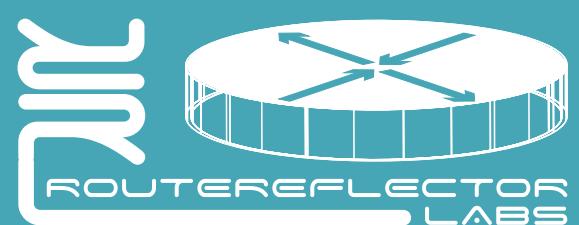
> WCCP (with HA)

Layer 3

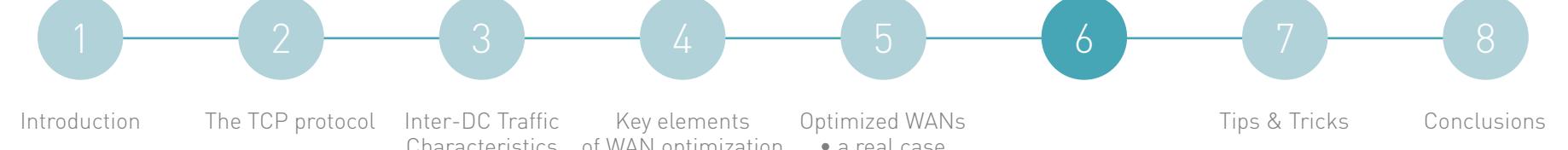


Cisco WAE Farm

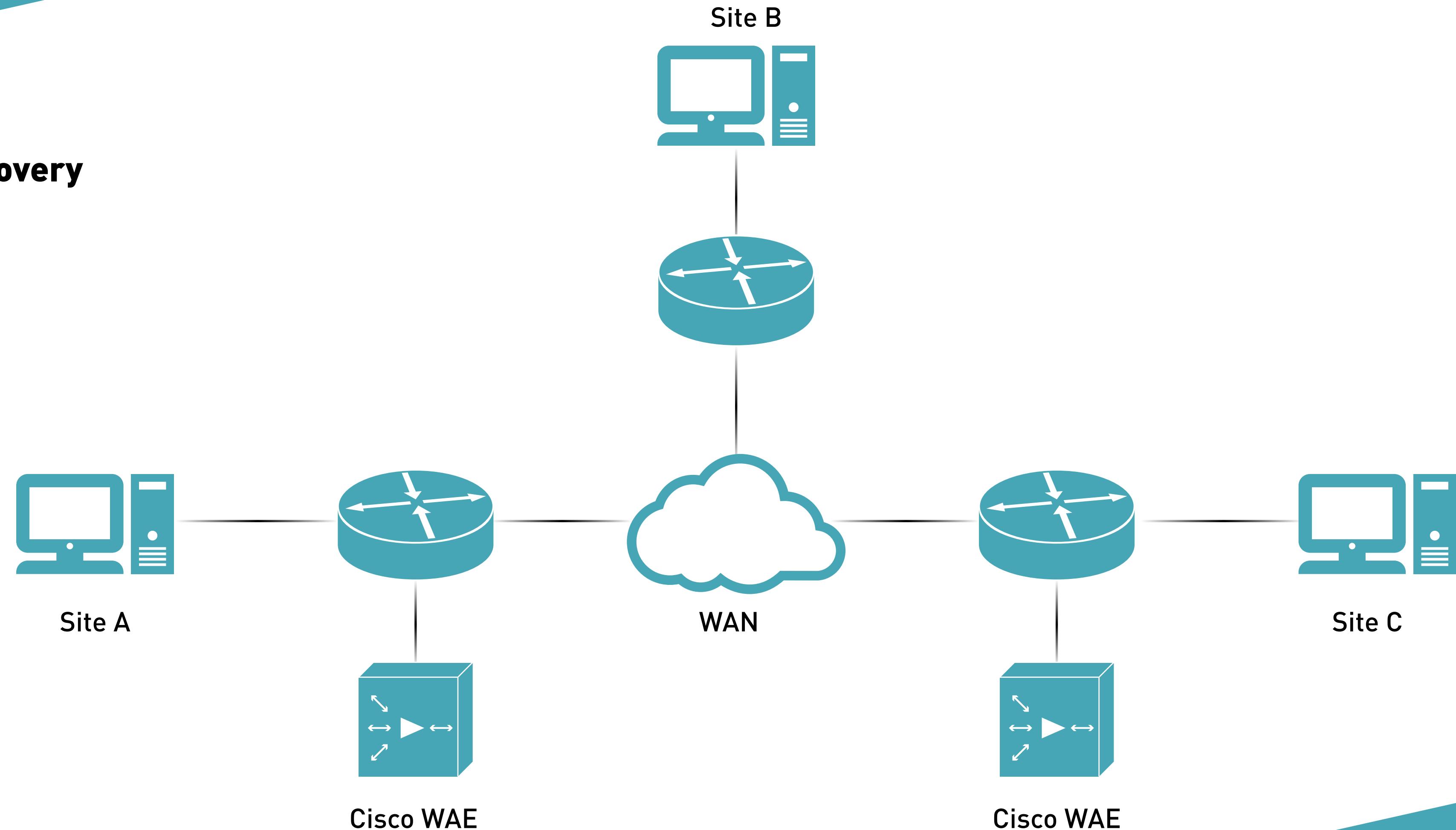
Andrea Dainese



> Designing a WAAS solution



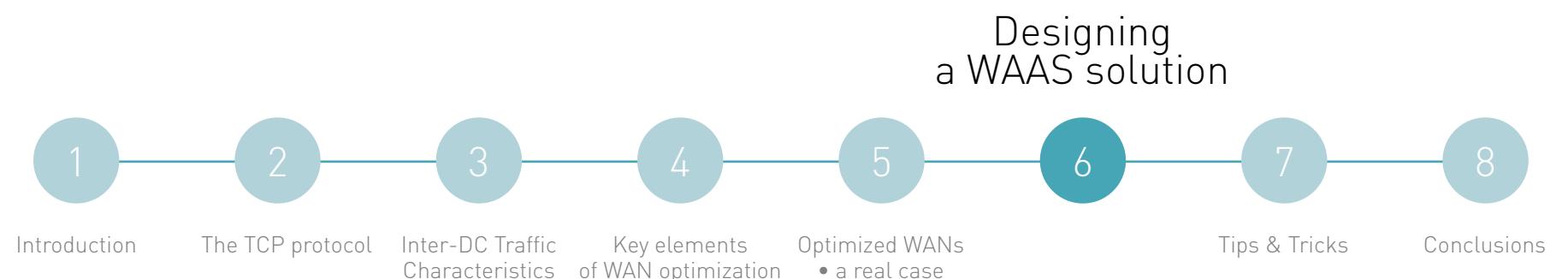
> Autodiscovery



Andrea Dainese



> Designing a WAAS solution



> **Inline VS WCCP**

- **Connected routers**
- **Resources**
- **Failover**
- **HA**
- **Scaling**

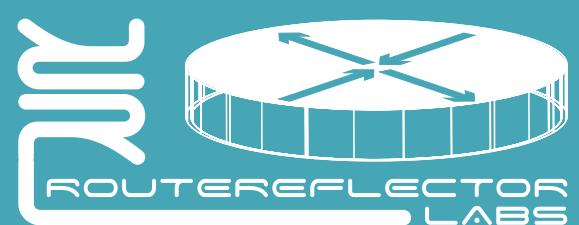
Inline

- 1
- Transparent
- Mechanical bypass mode
- Serial
- Scale-Up

WCCP

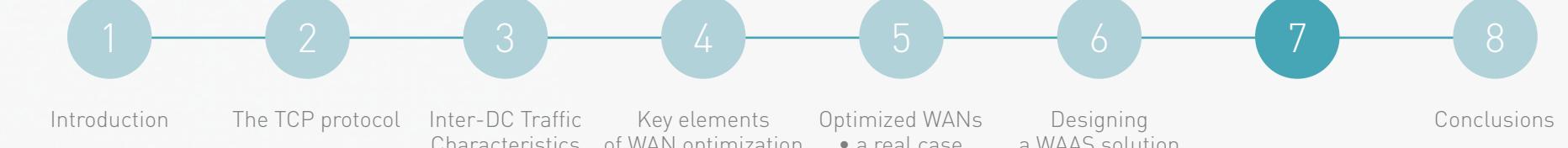
- Many
- CPU Intensive
- Keepalive
- Parallel
- Scale-Out

Andrea Dainese



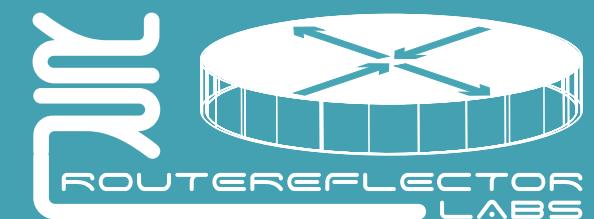
> Tips & Tricks

Tips & Tricks

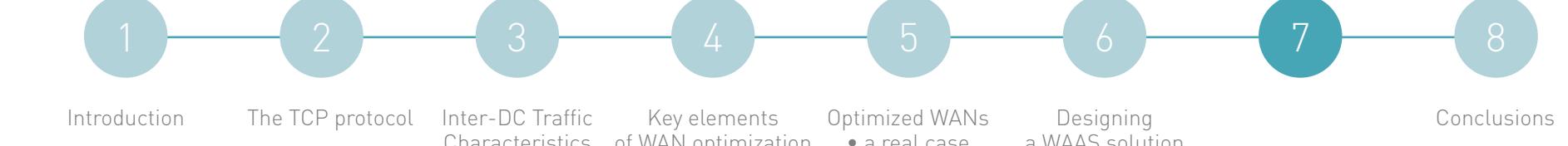


- > 1. Introduction
- > 2. The TCP protocol
- > 3. Inter-DC Traffic Characteristics
- > 4. Key elements of WAN optimization
- > 5. Optimized WANs - a real case
- > 6. Designing a WAAS solution
- > **7. Tips & Tricks**
- > 8. Conclusions

Andrea Dainese



TIPS & TRICKS



Tips & Tricks

- Do not optimize latency sensitive protocols (i.e. VoIP).
- Leave traffic uncompressed and unencrypted for better optimization.
- Install root certificates for HTTPS optimization.
- Add WAAS to AD for Encrypted MAPI optimization.
- Use CIFS optimization for faster folder browsing on branch offices.
- Consider disabling “Metadata Cache” and “local HTTP 301 Redirect” (i.e. Joomla).

Andrea Dainese

> Conclusions

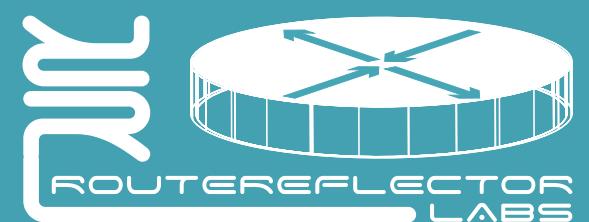
Conclusions



Introduction The TCP protocol Inter-DC Traffic Characteristics Key elements of WAN optimization Optimized WANs - a real case Designing a WAAS solution Tips & Tricks

- > 1. Introduction
- > 2. The TCP protocol
- > 3. Inter-DC Traffic Characteristics
- > 4. Key elements of WAN optimization
- > 5. Optimized WANs - a real case
- > 6. Designing a WAAS solution
- > 7. Tips & Tricks
- > **8. Conclusions**

Andrea Dainese



> Conclusions

Conclusions

1

Introduction

2

The TCP protocol

3

Inter-DC Traffic
Characteristics

4

Key elements
of WAN optimization

5

Optimized WANs
• a real case

6

Designing
a WAAS solution

7

Tips & Tricks

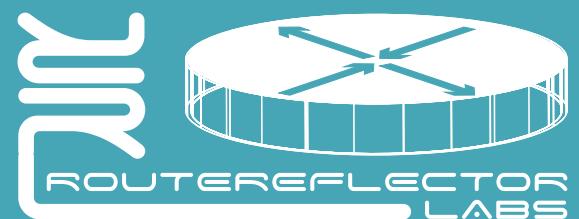
8

Does **WAN**
accelerators
(still) matter?



YES

Andrea Dainese



THANKS



andrea.dainese@gmail.com



<http://www.routereflector.com/>



<http://www.linkedin.com/in/adainese>



@adainese



Andrea Dainese

