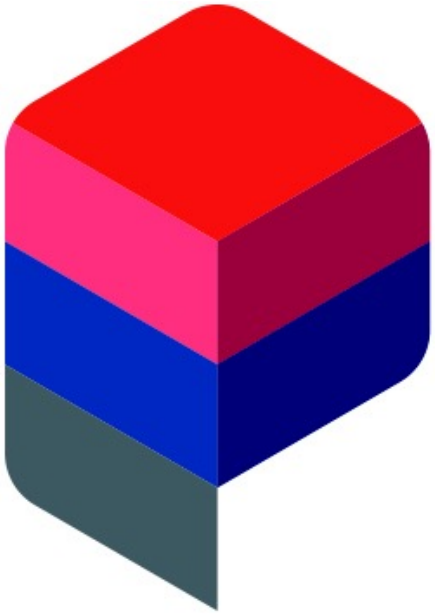


performing databases

Project Report
Oracle OLTP Benchmarks
against
Dell EMC RecoverPoint

Martin Klier

Performing Databases GmbH
Mitterteich / Germany

Speaker

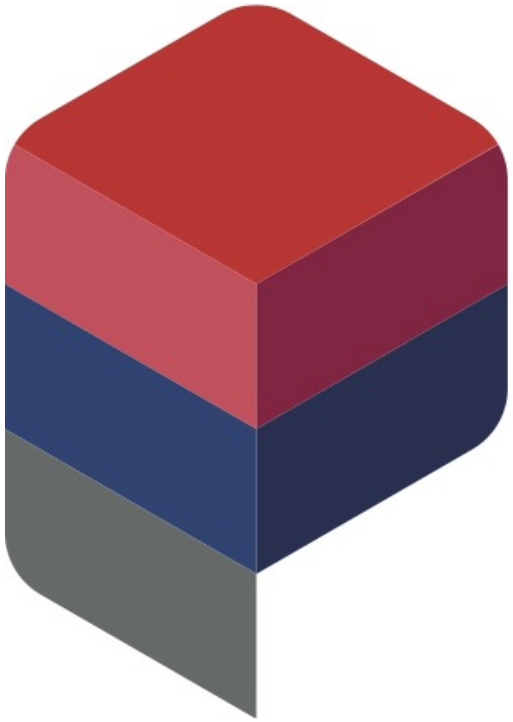
- Martin Klier
- Solution Architect and Database Expert
- My focus:
  - Performance + Tuning
  - Highly available systems
  - Cluster and Replication
- Linux since 1997
- Oracle Database since 2003

ORACLE ACE Director

Performing Databases

- Three Experts for Database technology
  - Concepts and Project Competence
  - Architecture- and System planning
  - Licensing
  - Implementation and Troubleshooting

- Get in touch
  - Performing Databases GmbH
    Wiesauer Strasse 27
    95666 Mitterteich // Germany
  - http://www.performing-databases.com
  - Twitter: @PerformingDB



TGW Logistics Group

- Systems Integrator for automated warehouse solutions
- End-to-end fulfillment
  - Design
  - Manufacturing
  - Implementation
  - Maintenance
- Locations:
  Austria, Germany, UK, USA
  and many more
- 3.800+ Employees
- 800+ Mio € revenue
- Foundation-owned, former Family-operated

www.tgw-group.com

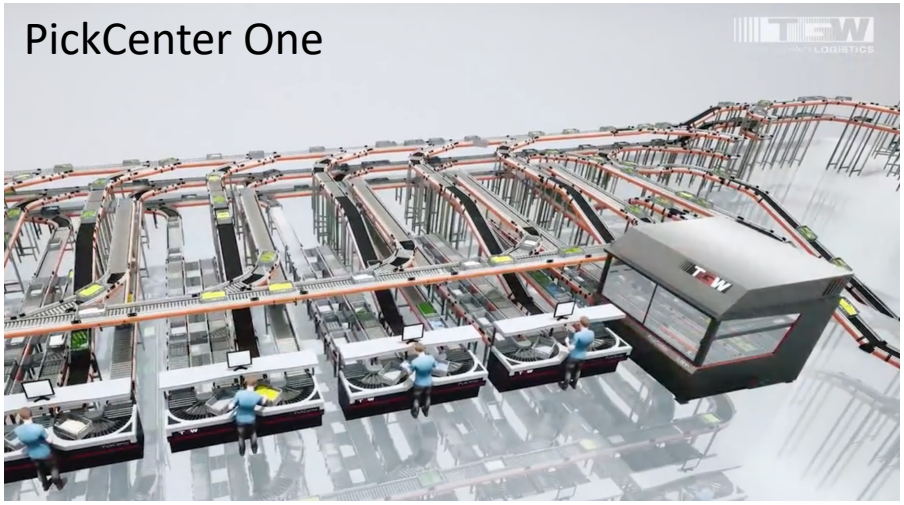
Project

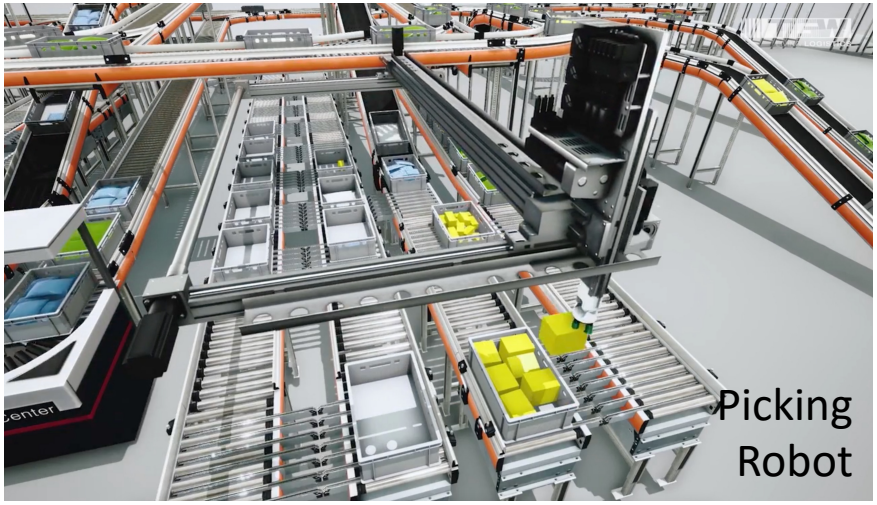

TGW
LIVING LOGISTICS

Stingray Shuttle


Stingray Shuttle Block

TGW LOGISTICS
LIVING LOGISTICS


PickCenter One


Picking Robot

Project Facts

- Greenfield Logistics Hub on 50.000m2
- Highly automated FlashPick® System
- >180.000 Storage Locations
- 200 energy-efficient Stingray shuttles in 10 aisles
- Automatic carton erection and closing
- Automatic crate stacking/lifting

- Two Oracle Databases 19c
  - Material Flow (“Routing”)
  - Warehouse Management (“Business”)
- Zero Data-loss concept w/ Data Guard
- High-class OLTP workload profile
- >2.000 transactions/second
- Oracle Linux on VMware vSphere ESXi

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Project Flow (2-3 years)

- Logistics Requirements
- Logistics Solutions Engineering
- Warehouse Layout Design
- Simulated Layout Validation
- Building / Construction
- Logistics + Software Realization
- IT Infrastructure Sizing based on Layout + Software
- **IT Infra Solution Engineering**
- **Benchmarked IT Infra Validation**
- IT Infra Realization
- Software Stress Testing / Emulation
- Commissioning Phase
- Production Ramp-up Phase
- Acceptance

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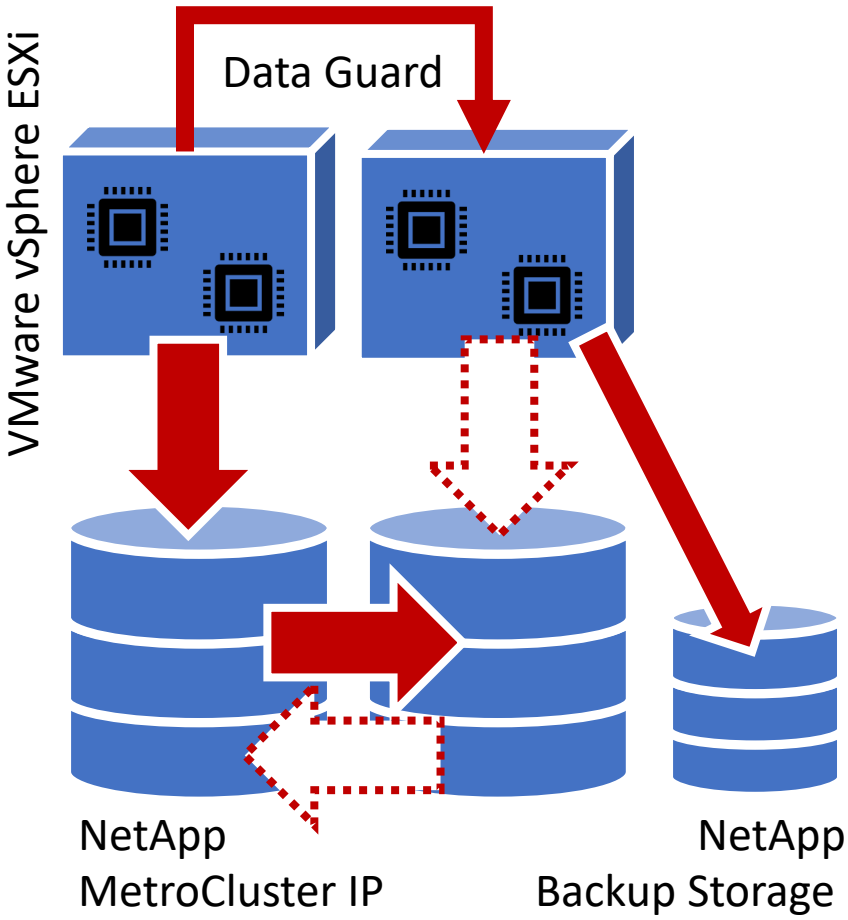
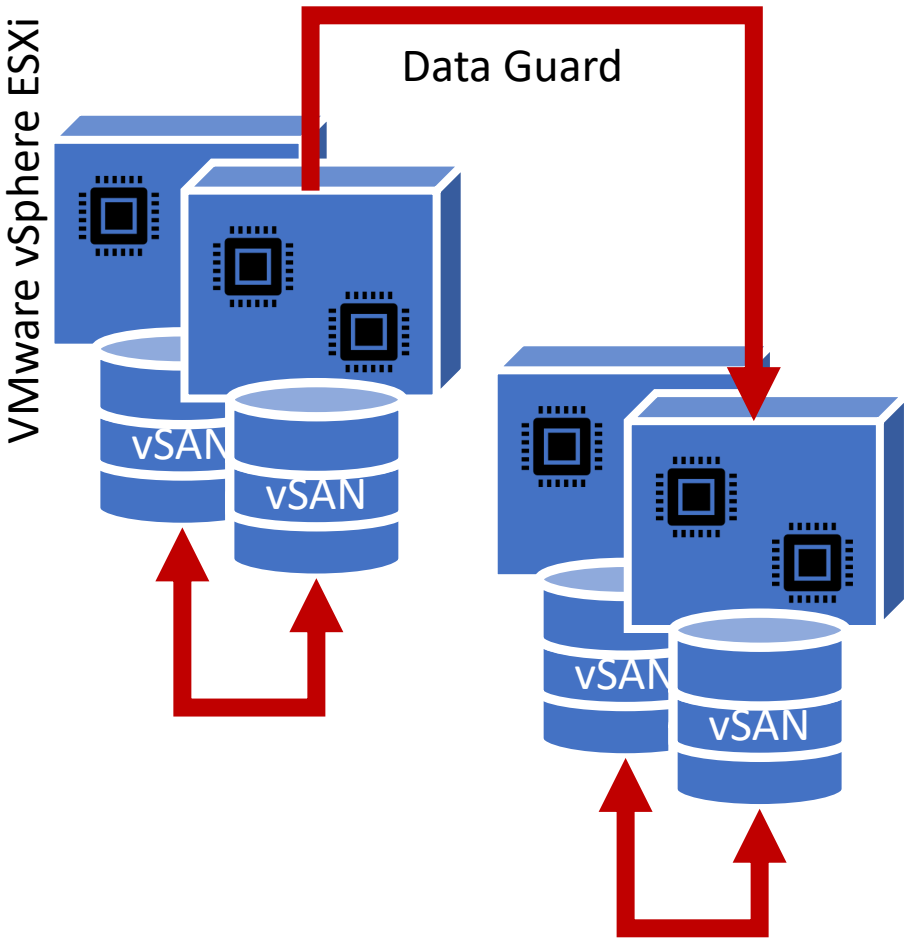
Solution-Jackstraws (Solution-Mikado)

Solution vs. Solution

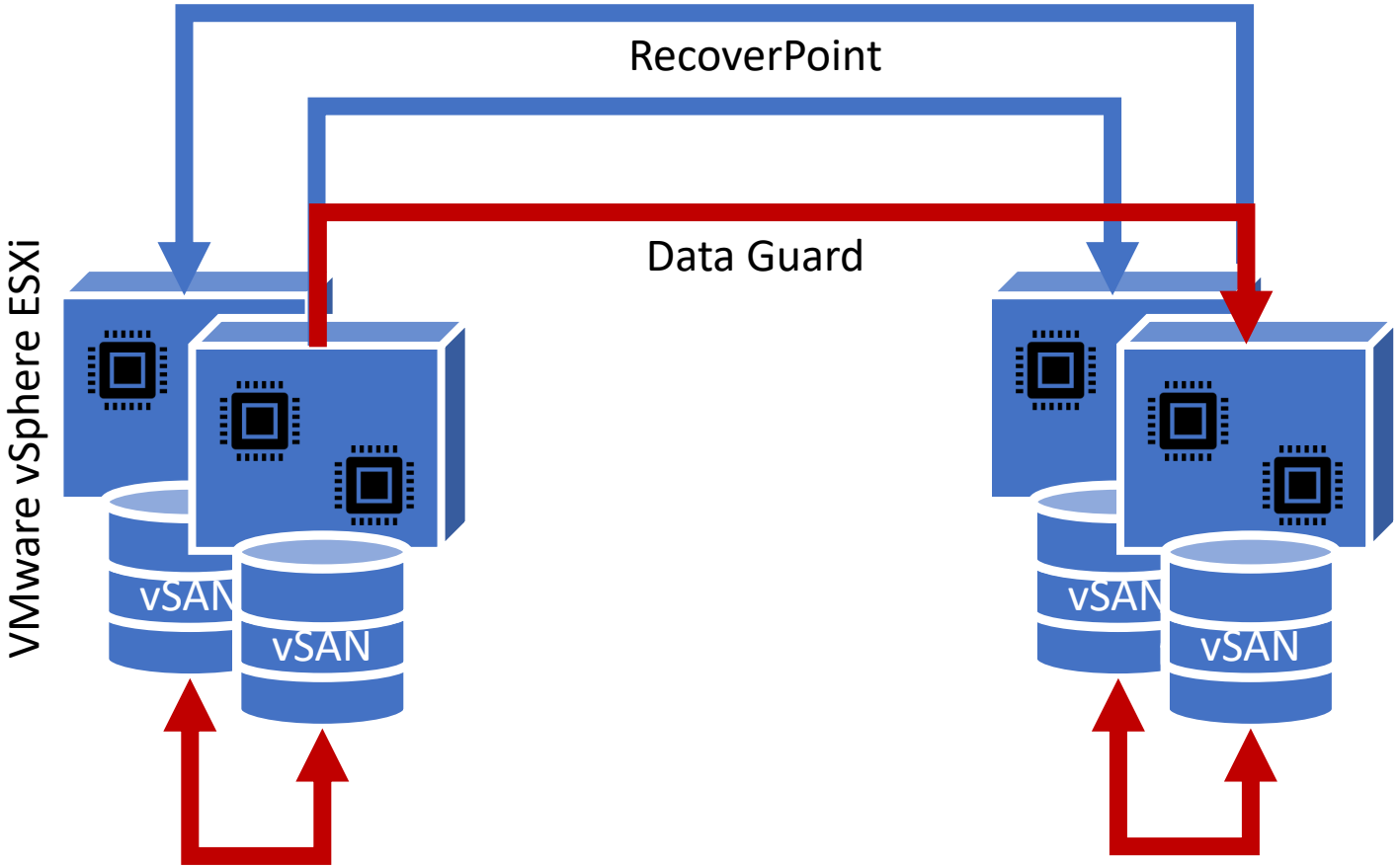
Proposed:



Wanted:



Compromise


RecoverPoint
Data Guard
VMware vSphere ESXi
vSAN
vSAN
vSAN
vSAN

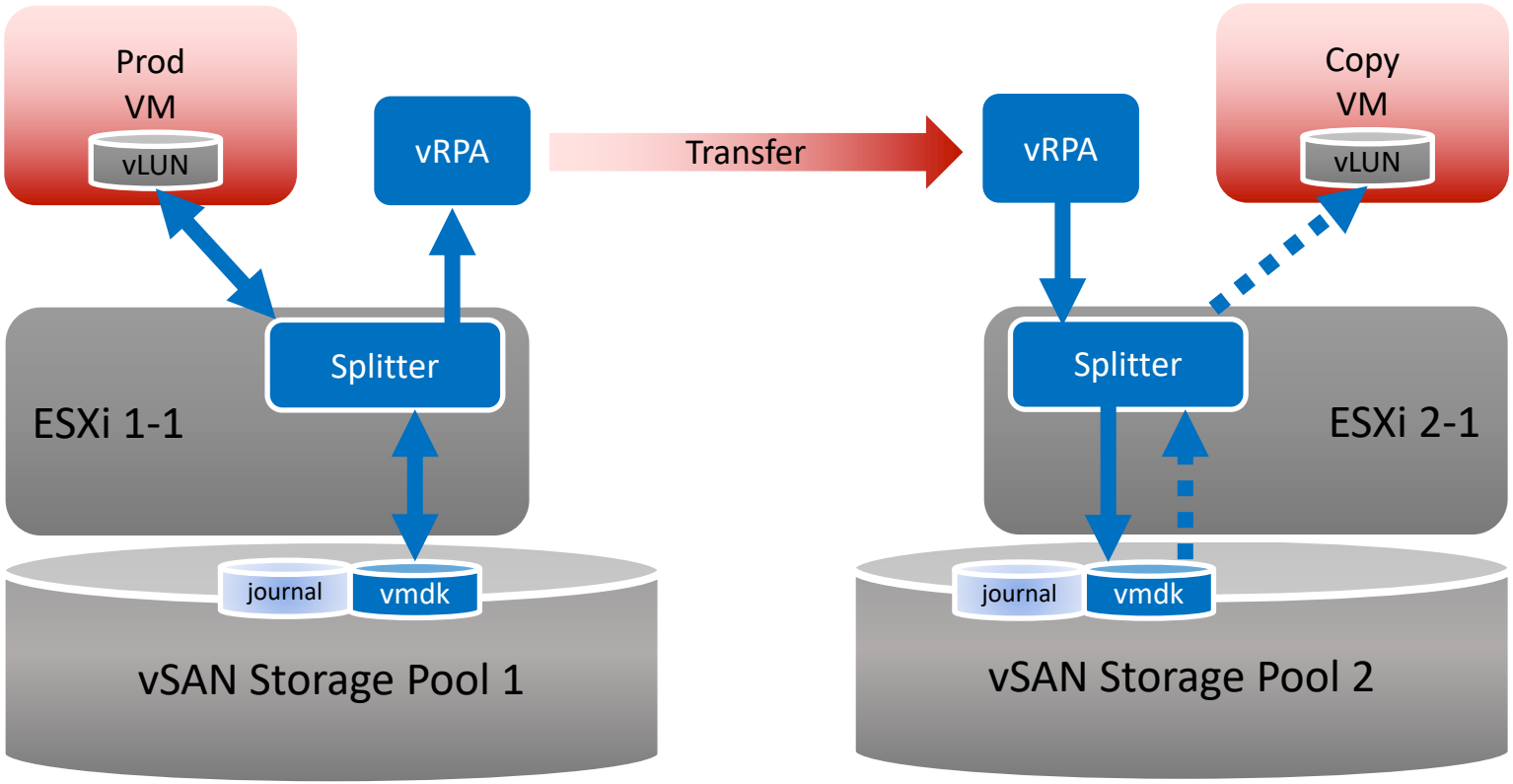
Per-for-mance

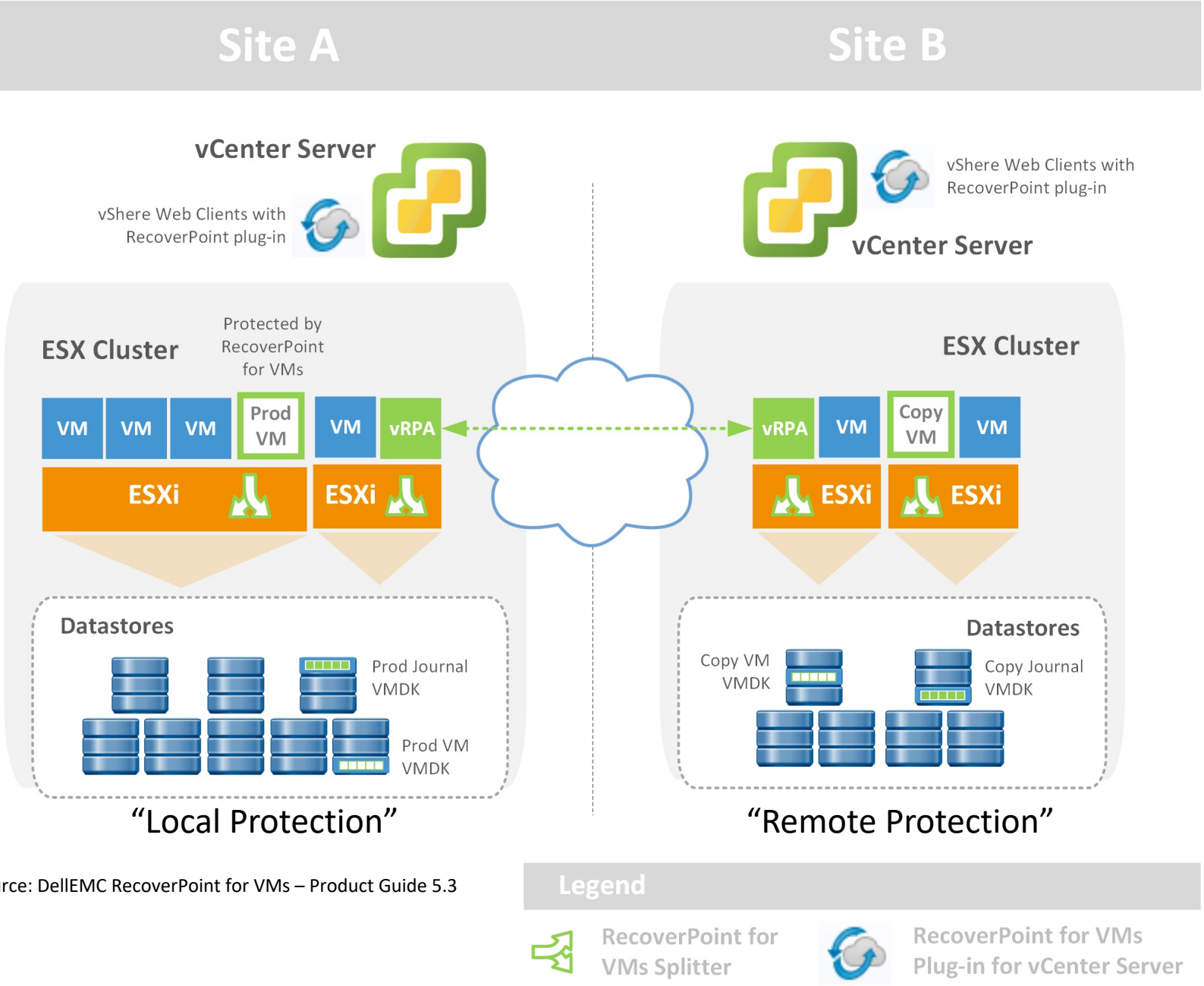
[pɚ. ˈfɔɹ.məns]

DellEMC RecoverPoint

DellEMC RecoverPoint

How it works, simplified





Source: DellEMC RecoverPoint for VMs – Product Guide 5.3

Legend

RecoverPoint for VMs Splitter

RecoverPoint for VMs Plug-in for vCenter Server

Benchmarking

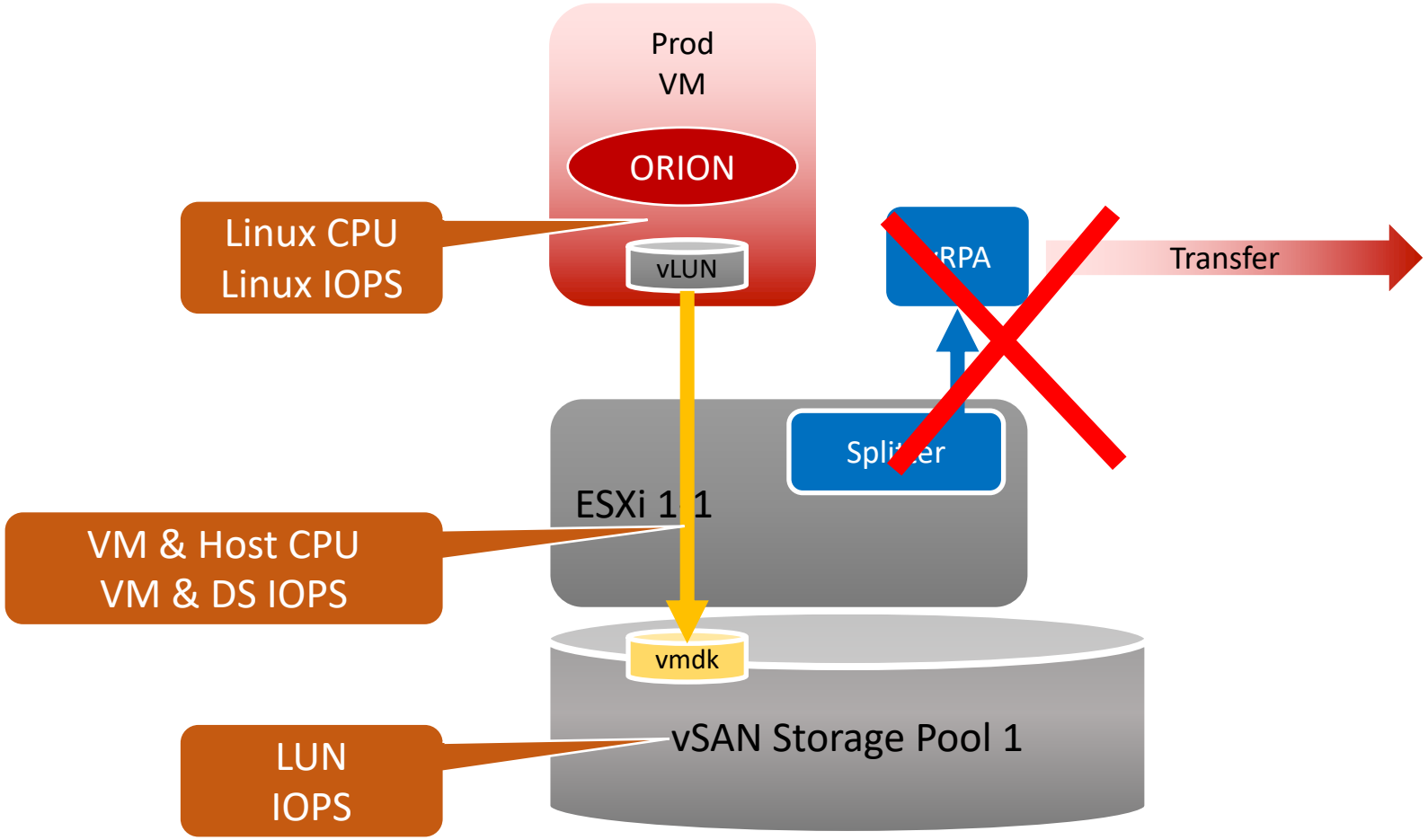
Limit your Benchmark Scope!

- NOT:
  - ~~Which one is better?~~
  - ~~Comparison to another solution.~~
  - ~~Prove somebody wrong.~~

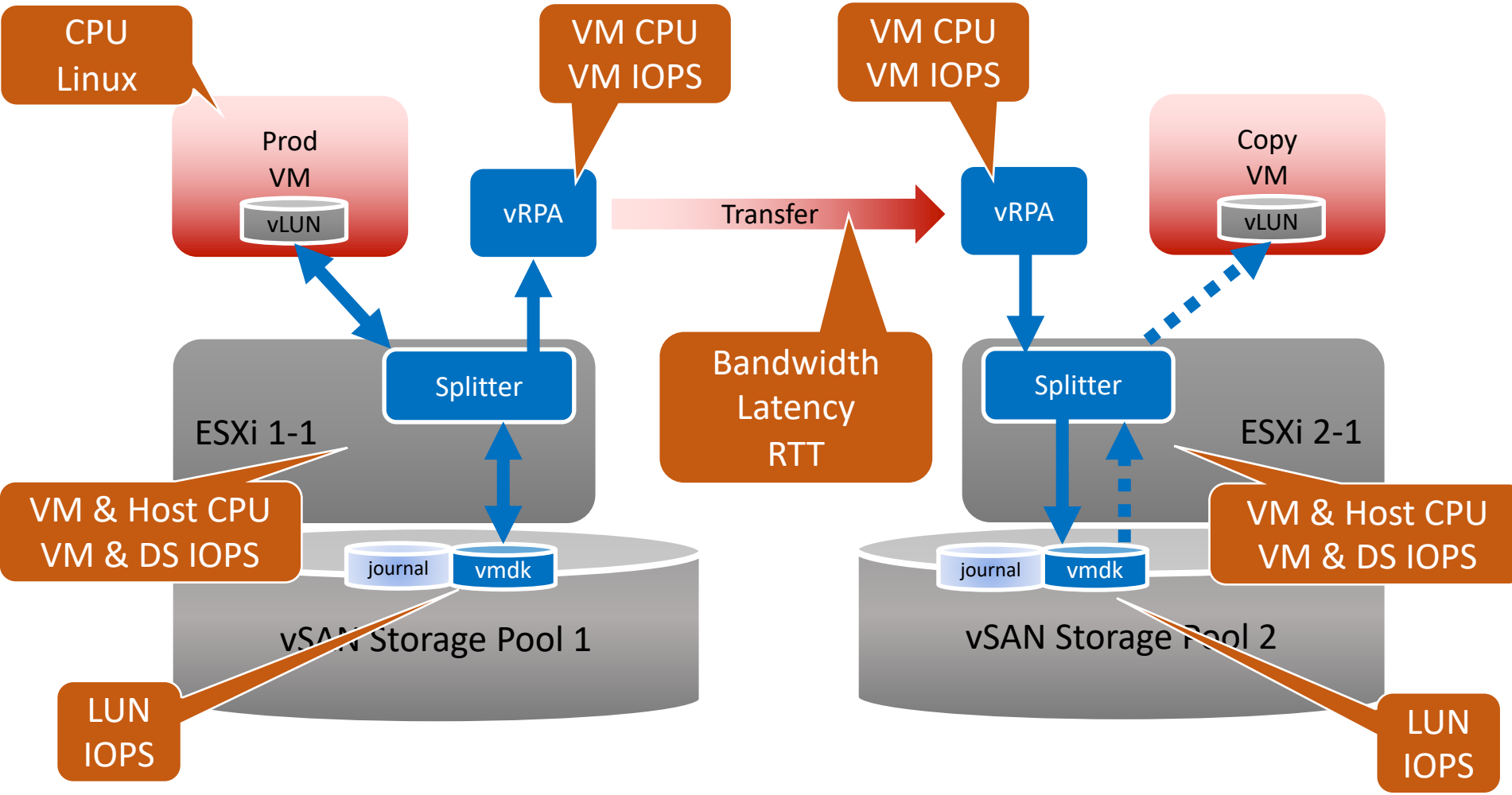
- Answer this:
  - Is the “Compromise” solution fast enough for proposed warehouse ops?
    - 2000 Transactions/second
    - 10.000 IOPS
    - <5ms Latency
  - ~~Is the “Compromise” solution robust enough? (not covered in this talk)~~
    - ~~”Pull the plug” under full transactional load~~
    - ~~Use the “Remote Protection” VMDKs to re-start the database~~
    - ~~How long does it take to crash-recover? (Or any other recovery necessary?)~~

IO per second
IO Latency

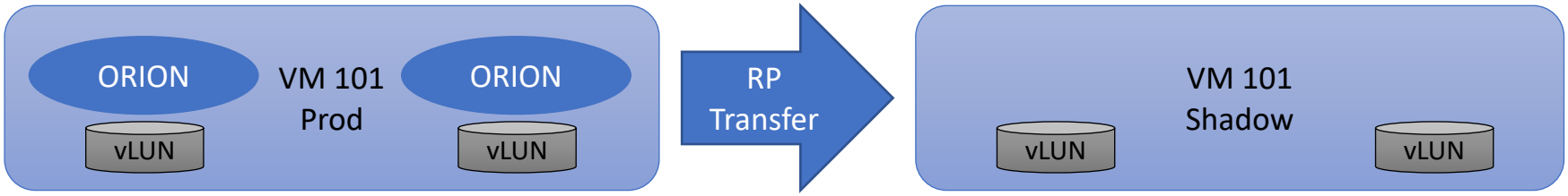
IO Stress Test - Baseline Setup



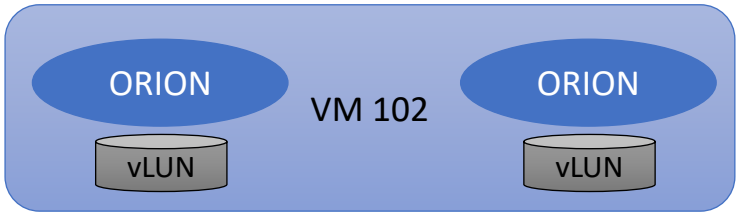
Bottlenecks United



ORION Test Setup



run “read1” run “read2”



run “read1” run “read2”

“Single-LUN-Performance” .... ☹

- Four ORION executions precisely at the same time
  - Two on a protected VM
  - Two on an unprotected VM
- Four LUNs overall
  - on the same vSAN, to max it out
  - Two protected
  - Two unprotected

ORION Test Setup

$ORACLE_HOME/bin/orion	
-run advanced	Test Profile
-testname oltp-read	Identification (LUN file, Output)
-num_disks 20	How much power (=threads, Q)
-cache_size 8192	How much cache to saturate
-size_small 8	Small IO size
-size_large 16	n/a (limited test matrix)
-type rand	IO Profile
-simulate raid0	n/a (here single LUN)
-write 20	Write Percentage (0=100% read)
-duration 30	How long per data point
-matrix basic	Which tests to run

ORION Test Results

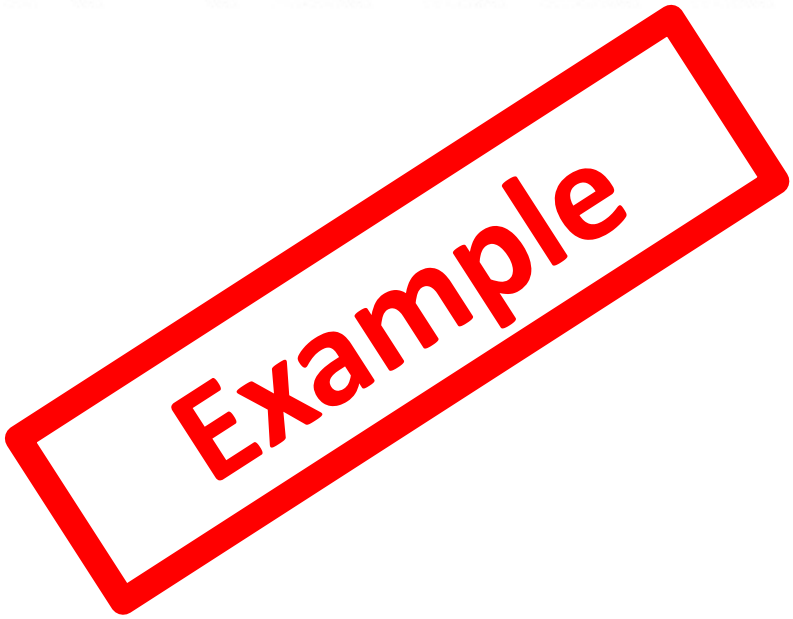
```
$ ls -1 oltp-read1*
    oltp-read1.lun
    oltp-read1_20210415_1320_hist.txt
    oltp-read1_20210415_1320_iops.csv
    oltp-read1_20210415_1320_lat.csv
    oltp-read1_20210415_1320_mbps.csv
    oltp-read1_20210415_1320_summary.txt
    oltp-read1_20210415_1320_trace.txt
```

```
ORION VERSION RDBMS_19.3.0.0.0DBRU_LINUX.X64_190417

Command line:
-run advanced -testname oltp-write -num_disks 16 -cache_size 8192 -size_small 8 -size_large 16 -type rand -simulate raid0

These options enable these settings:
Test: oltp-write
Small IO size: 8 KB
Large IO size: 16 KB
IO types: small random IOs, large random IOs
Sequential stream pattern: RAID-0 striping for all streams
Writes: 80%
Cache size: 8192 MB
Duration for each data point: 5 seconds
Small Columns:,      0
Large Columns:,      0,      1,      2,      4,      6,      8,      ,      12,     ,      18,     20,     22,
Total Data Points: 41

Name: /dev/disk/by-id/BENCHMARK1        Size: 322122547200
1 files found.

Maximum Large MBPS=209.60 @ Small=0 and Large=32

Maximum Small IOPS=19563 @ Small=60 and Large=0
Small Read Latency: avg=1616.936 us, min=153.961 us, max=5673.406 us, std dev=574.261 us @ Small=60 and Large=0
Small Write Latency: avg=3428.564 us, min=1516.842 us, max=7062.202 us, std dev=678.150 us @ Small=60 and Large=0

Minimum Small Latency=852.863 usecs @ Small=1 and Large=0
Small Read Latency: avg=372.455 us, min=190.038 us, max=2469.994 us, std dev=117.754 us @ Small=1 and Large=0
Small Write Latency: avg=976.756 us, min=637.569 us, max=3245.912 us, std dev=206.006 us @ Small=1 and Large=0
Small Read / Write Latency Histogram @ Small=60 and Large=0
        Latency:                        # of IOs (read)            # of IOs (write)
        0 - 128         us:               0 (  0.00%)               0 (  0.00%)
      128 - 256         us:             177 ( 14.74%)               0 (  0.00%)
      256 - 512         us:             990 ( 97.17%)               0 (  0.00%)
      512 - 1024        us:              31 ( 99.75%)            2927 ( 62.85%)
     1024 - 2048        us:               2 ( 99.92%)            1717 ( 99.72%)
     2048 - 4096        us:               1 (100.00%)              13 (100.00%)
     4096 - 268435456   us:               0 (100.00%)               0 (100.00%)
oltp-write_20210414_1043_summary.txt (END)
```

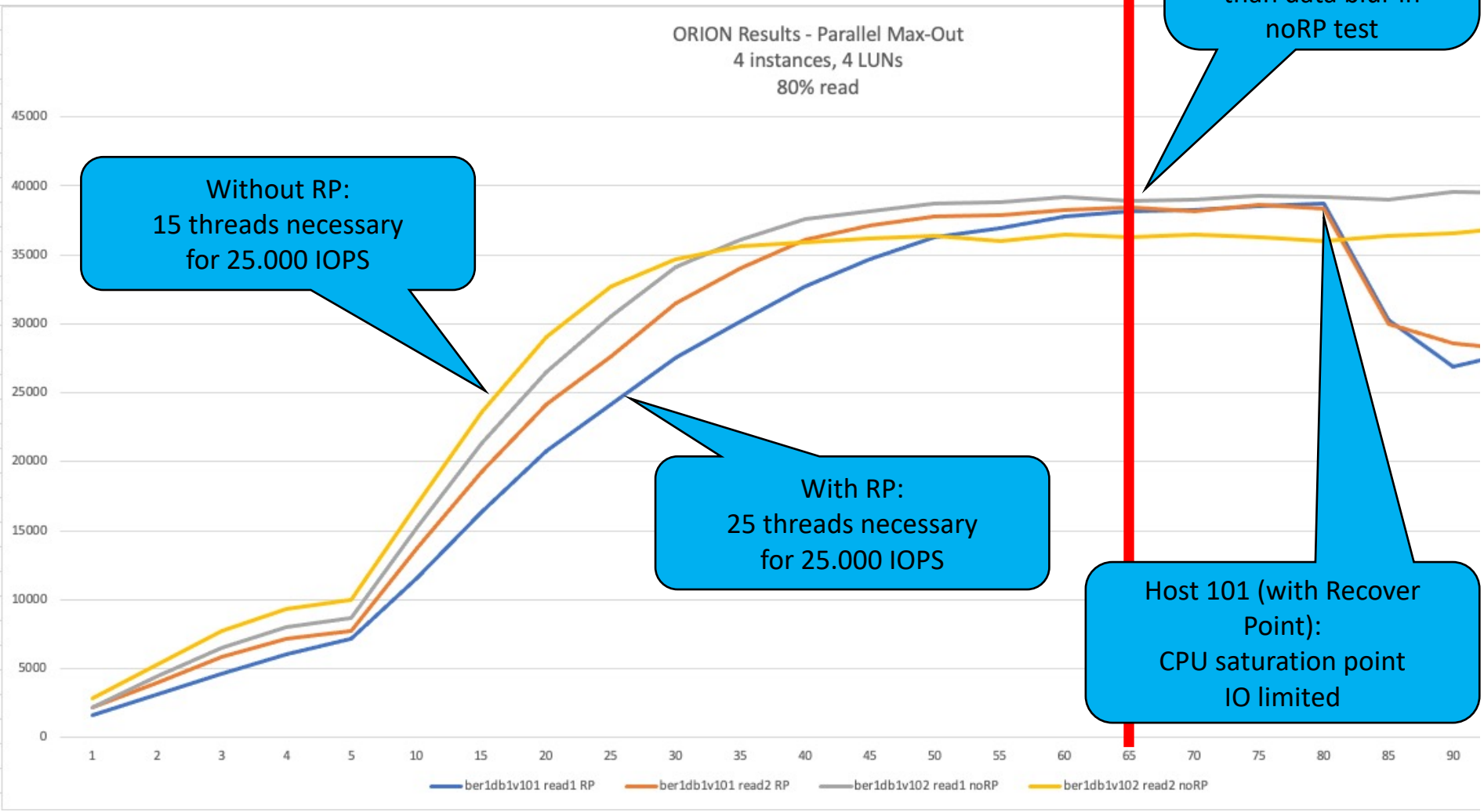
Example

ORION Test Results

```
This comma-separated-value file contains the rates sustained by small I/Os in IOPS.
Each value corresponds to a data point test that used a fixed number of outstanding small and large I/Os.
The number of outstanding small I/Os for a value is specified by its column header in the first row.
The number of outstanding large I/Os for a value is specified by its row header in the first column.

Large/Small,      1,      2,      3,      4,      8,     12,     16,     20,     24,     28,     32,     36,     4
           0,   1171,   2266,   3271,   4274,   6432,   7580,   9685,  11587,  13236,  14462,  15888,  16880,  1773
           1
           2
           4
           6
           8
          10
          12
          14
          16
          18
          20
          22
          24
          26
          28
          30
          32
```

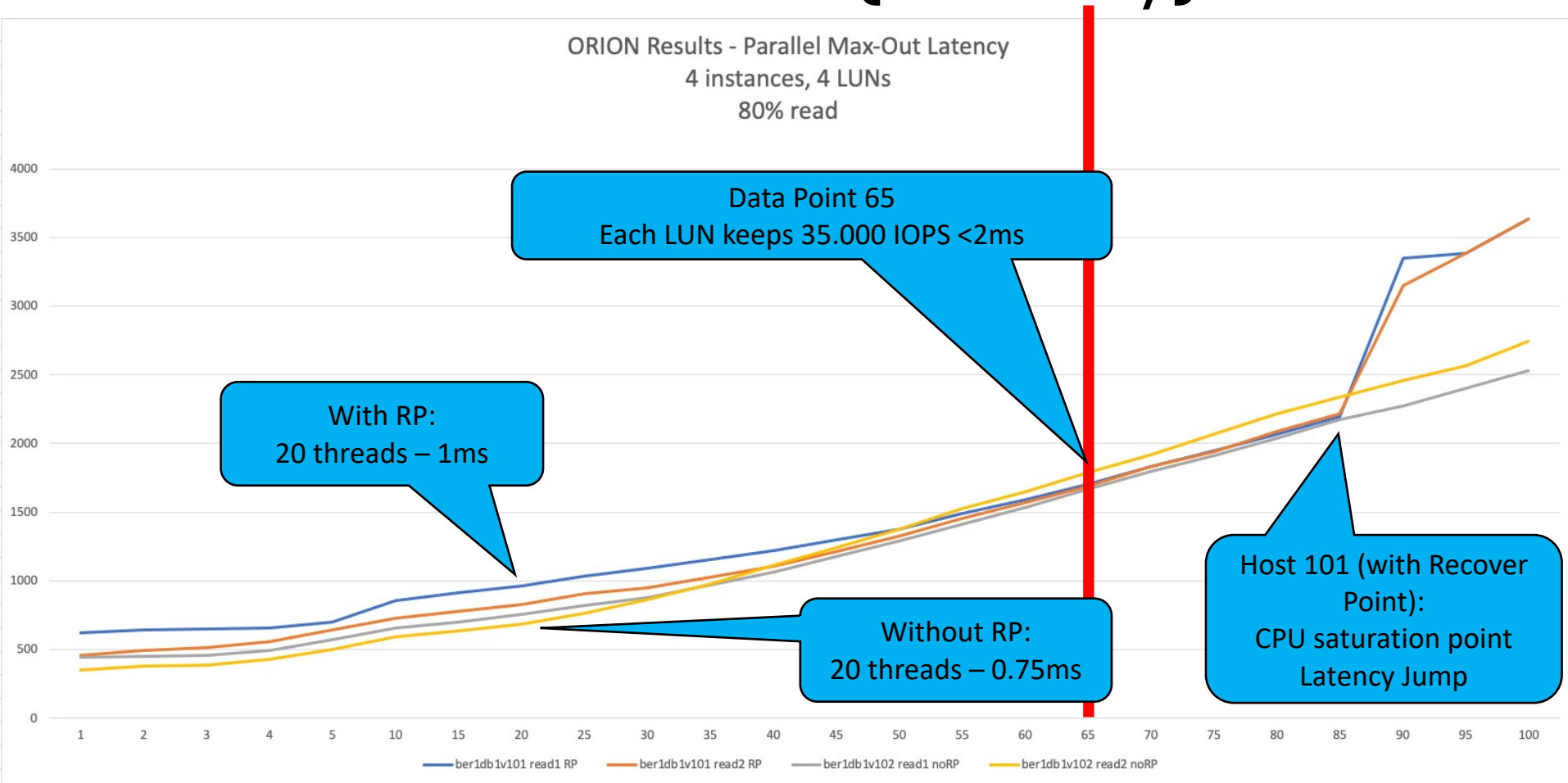


ORION Results (IOPS)

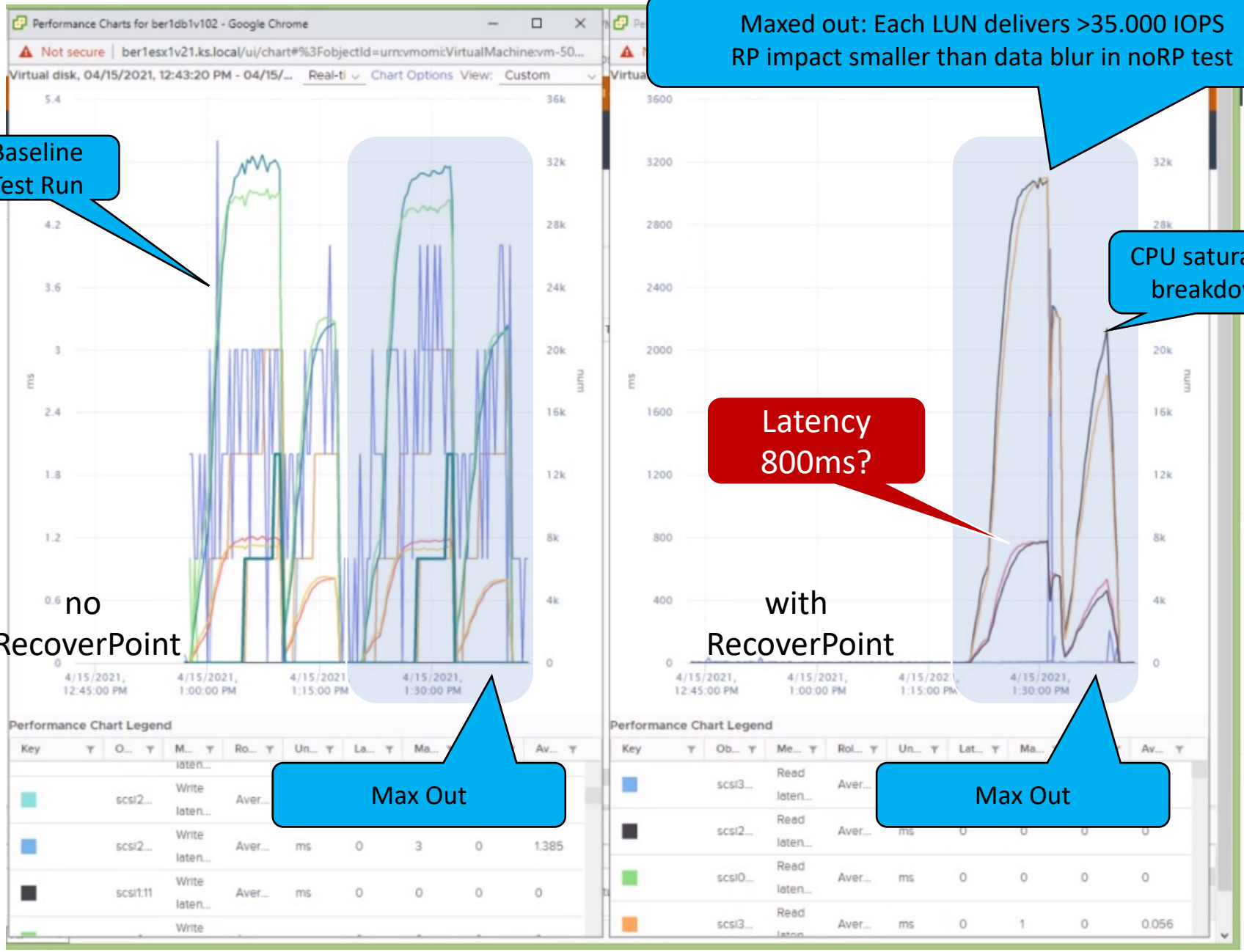


Remark: This is baseline, RecoverPoint result, and Max-Out test in one single graph

ORION Results (Latency)



Remark: This is baseline, RecoverPoint result, and Max-Out test in one single graph


Maxed out: Each LUN delivers >35.000 IOPS
RP impact smaller than data blur in noRP test
Baseline Test Run
CPU saturation breakdown
Latency 800ms?
no RecoverPoint
with RecoverPoint
Max Out
Max Out
Performance Charts for ber1db1v102 - Google Chrome
Performance Chart Legend
Performance Chart Legend

ORION Results (Latency)

Latency Histogram for small IOs @ Small=65 and Large=0

Latency:		# of IOs (read)	# of IOs (write)
0 - 64	us:	0 (0.00%)	0 (0.00%)
64 - 128	us:	65 (0.01%)	0 (0.00%)
128 - 256	us:	115 (0.02%)	0 (0.00%)
256 - 512	us:	19743 (2.18%)	0 (0.00%)
512 - 1024	us:	420127 (48.10%)	0 (0.00%)
1024 - 2048	us:	466006 (99.04%)	0 (0.00%)
2048 - 4096	us:	8794 (100.00%)	98737 (43.08%)
4096 - 8192	us:	17 (100.00%)	129608 (99.64%)
8192 - 16384	us:	0 (100.00%)	824 (100.00%)
16384 - 268435456	us:	0 (100.00%)	0 (100.00%)

Latency Histogram for small IOs @ Small=100 and Large=0

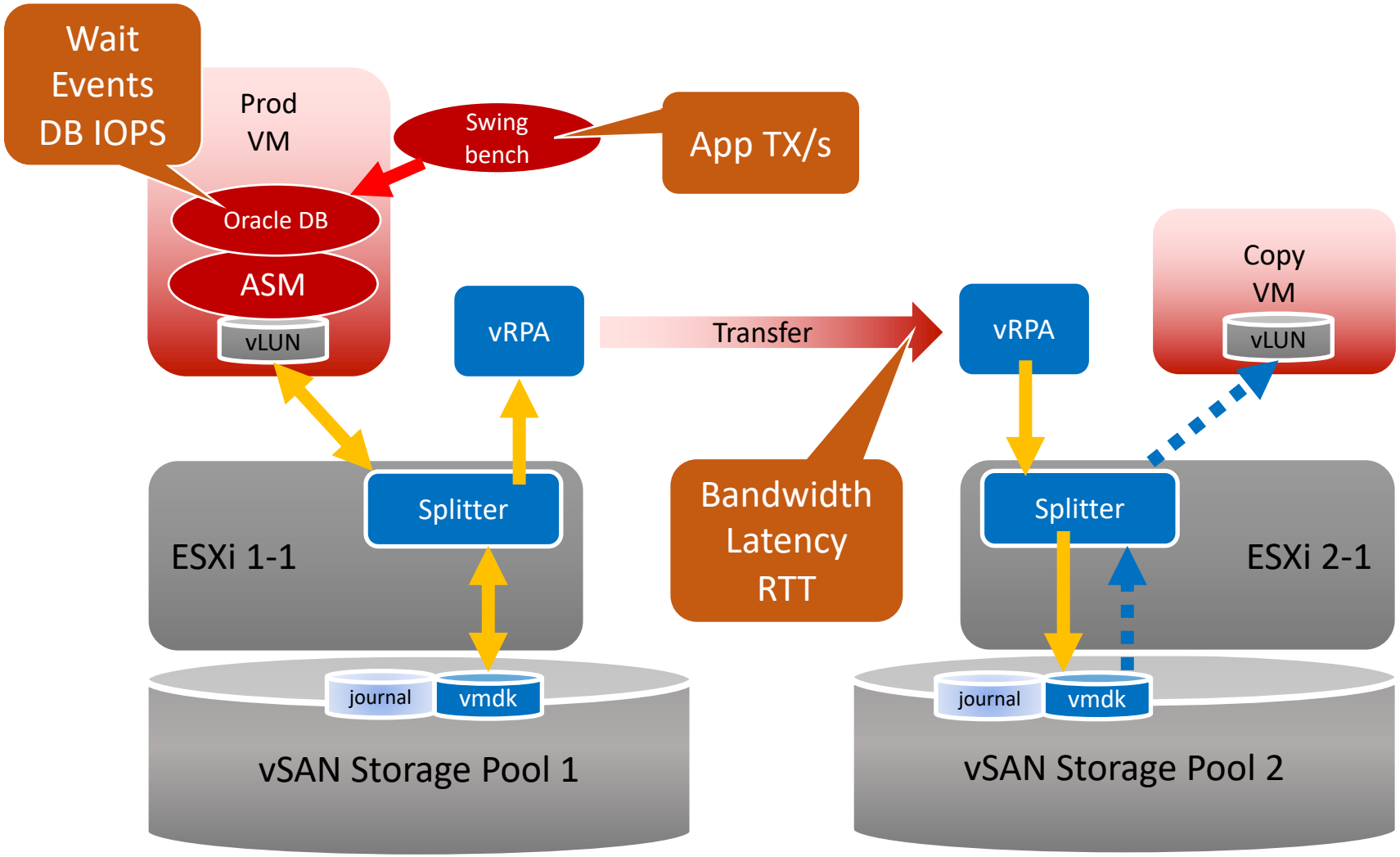
Latency:		# of IOs (read)	# of IOs (write)
0 - 64	us:	0 (0.00%)	0 (0.00%)
64 - 128	us:	2 (0.00%)	0 (0.00%)
128 - 256	us:	71 (0.01%)	0 (0.00%)
256 - 512	us:	1131 (0.18%)	0 (0.00%)
512 - 1024	us:	11666 (1.95%)	0 (0.00%)
1024 - 2048	us:	410422 (64.21%)	0 (0.00%)
2048 - 4096	us:	234620 (99.80%)	3911 (2.36%)
4096 - 8192	us:	1093 (99.97%)	157912 (97.86%)
8192 - 16384	us:	0 (99.97%)	1368 (98.68%)
16384 - 32768	us:	0 (99.97%)	1 (98.68%)
32768 - 65536	us:	10 (99.97%)	0 (98.68%)
65536 - 131072	us:	0 (99.97%)	90 (98.74%)
131072 - 262144	us:	19 (99.97%)	91 (98.79%)
262144 - 524288	us:	185 (100.00%)	1905 (99.94%)
524288 - 1048576	us:	8 (100.00%)	92 (100.00%)
1048576 - 268435456	us:	0 (100.00%)	0 (100.00%)

Average sucks ;)

Remark: This is baseline, RecoverPoint result, and Max-Out test in one single graph

Transactions / Second

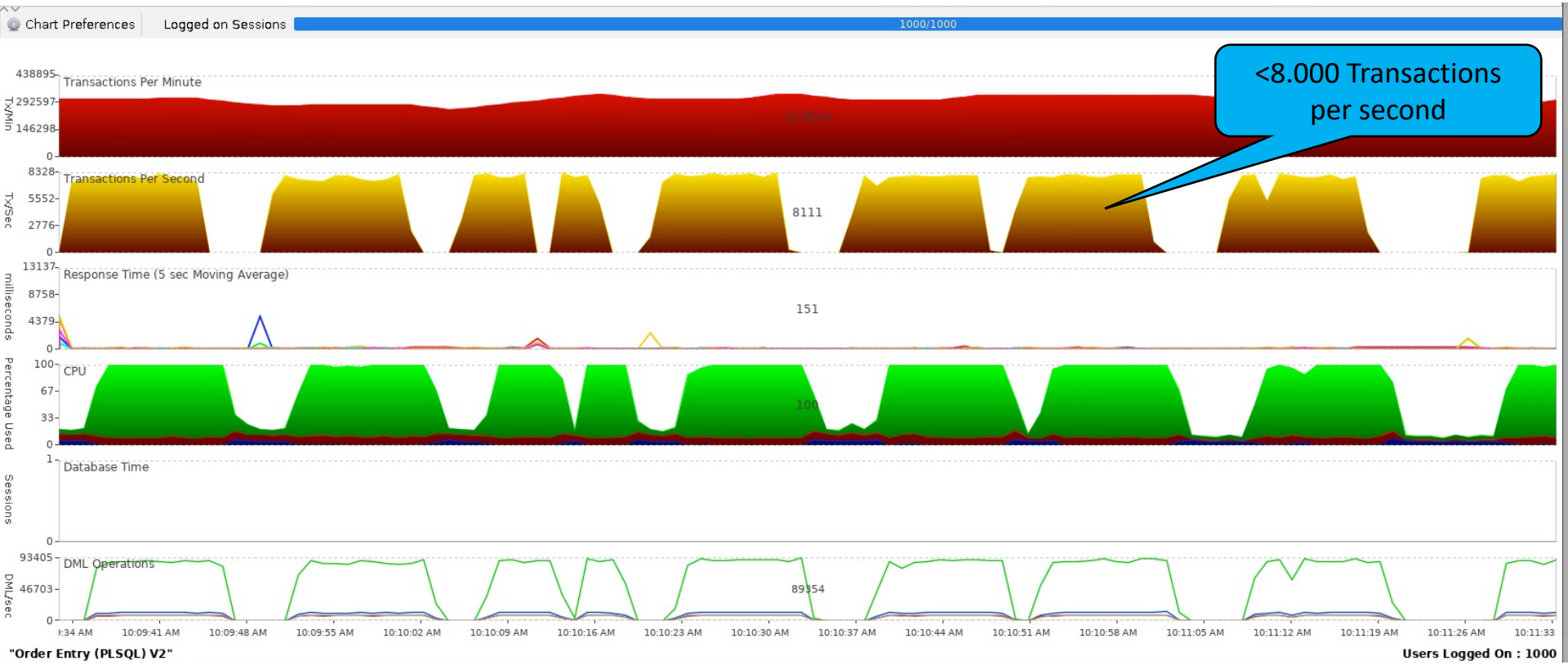
Swingbench Setup



Swingbench Setup

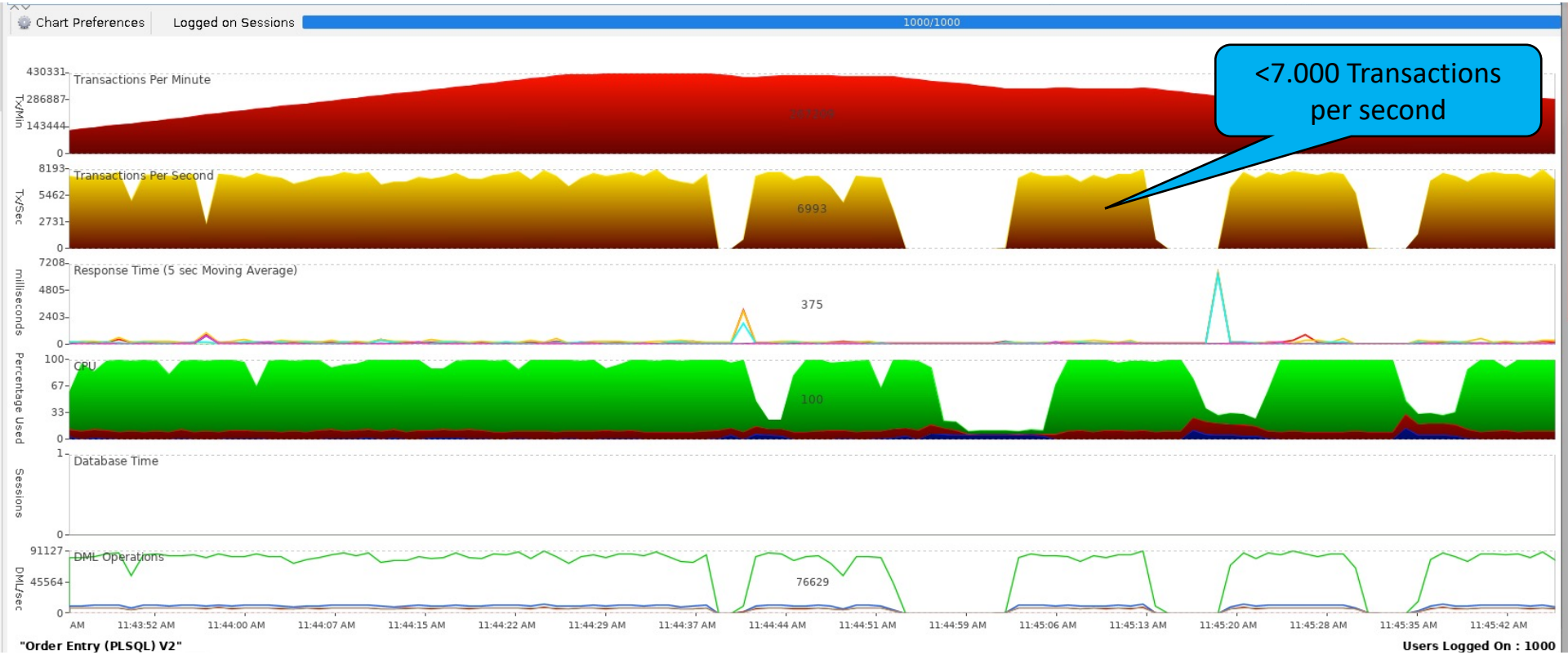
- Order Entry v 2.0
- IO-bound setup
  - „small“ SGA (10GB)
  - „big“ Tablespace (300GB)
- Increased No. of users until saturation (=1000)

Swingbench Baseline – no RP



Expected
2.000+ TX/s

Swingbench Results – with RP



Expected
2.000+ TX/s

Results

Metric	Warehouse Ops Request	w/o RecoverPoint	with Recover Point
IOPS	>10.000	>35.000 steep scaling	>35.000 relatively “flat” scaling
IO Latency	<5ms	avg. <2ms peak 5ms	avg. <2ms peak 800ms
Transactions/s	>2.000	>8.000	>7.000

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Thank you!

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Meet & Greet

martin.klier@performing-db.com
www.performing-databases.com

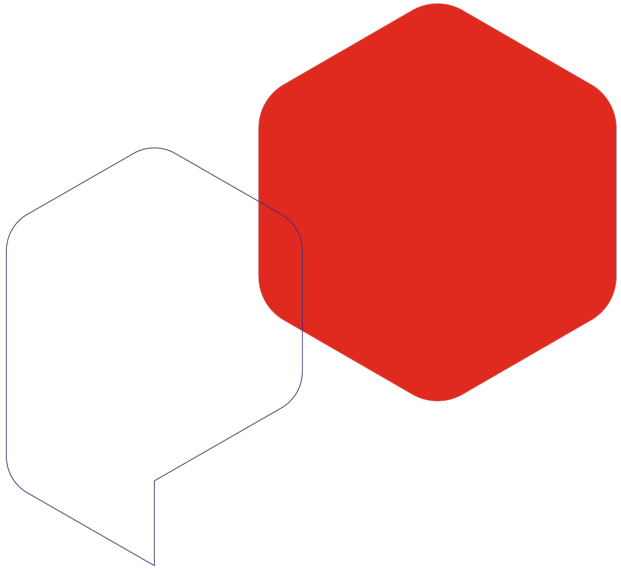
Many national // international events

DOAG
Deutsche ORACLE-Anwendergruppe e.V.

IT-Tage
2021

Efficiency is

to stay in touch!



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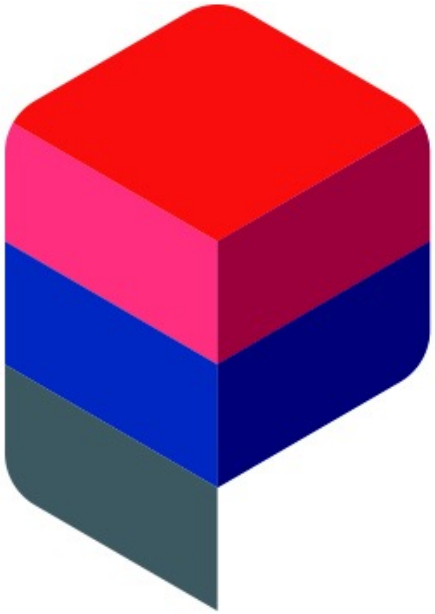

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