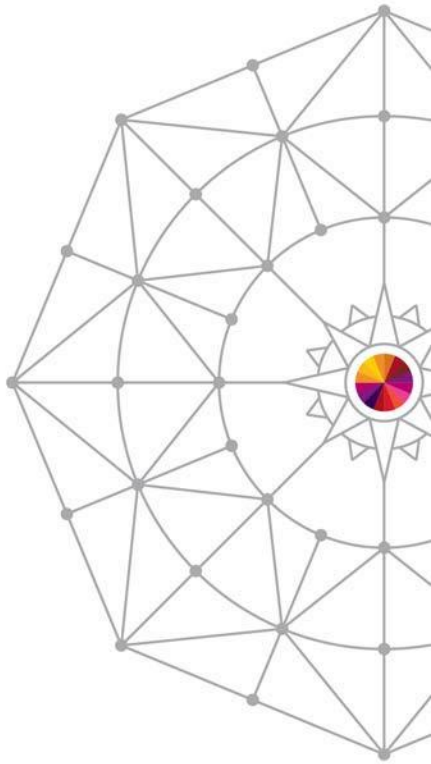
z/OS Performance Case Studies on zHPF & Coupling Facility



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Agenda

1. Brief Overview of IntelliMagic Technology
   - "Who is IntelliMagic and what was used to create the case studies?"
2. Case Study: zHPF Projections
   - *"What are the ramifications of zHPF to my channel configuration?"*
3. Case Study: zHPF Before/After Analysis
   - *"What performance difference has zHPF made for my workloads?"*
4. Case Study: Coupling Facility Efficiency Analysis
   - *"Is the CF configuration optimal and are there CPU ramifications?"*

About IntelliMagic

- IntelliMagic is a leader in advanced predictive analytics, especially for large data storage infrastructures
- Over 20 years developing storage performance solutions
- Privately held, financially independent
- Customer centric and highly responsive
- IntelliMagic Products are used daily at some of the largest mainframe sites in the country

IntelliMagic Vision

Protect availability with automated visibility inside your storage infrastructure

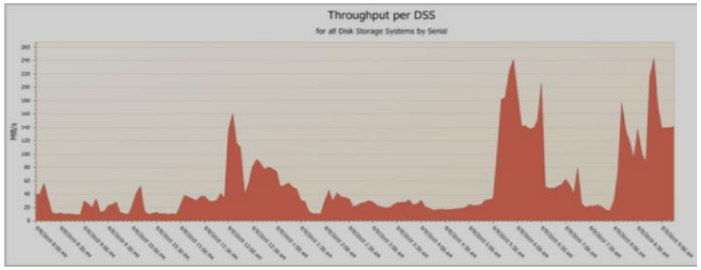
IntelliMagic Direction

Model how different storage hardware options would service your workloads

The IntelliMagic Difference

Classic Data Presentation

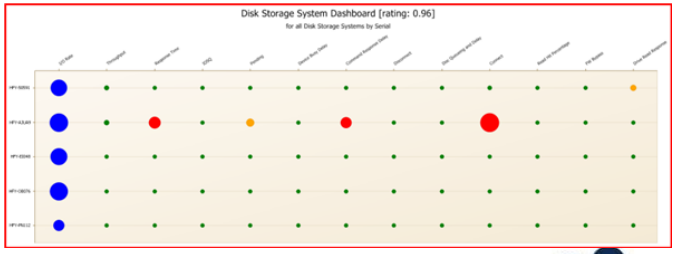
- Charts show data as-is, with no context knowledge
- Hard to know where to look
- Users need to be expert to distinguish good and bad
- Impractical to use proactively for avoidance



- Think RMF printed reports, RMF XML, CA MICS, MXG....

Predictive Analytics

- Data is mined using rules and knowledge base
- Summarizes risks & health
- Incorporates knowledge on both workloads & hardware
- Intelligent grouping of relevant metrics
- Provides recommendations



- Think IntelliMagic Vision

Risk Assessment Dashboards

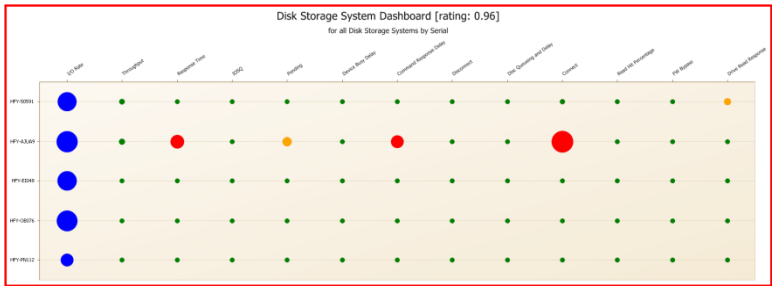
"IntelliMagic"

Exception

Warning

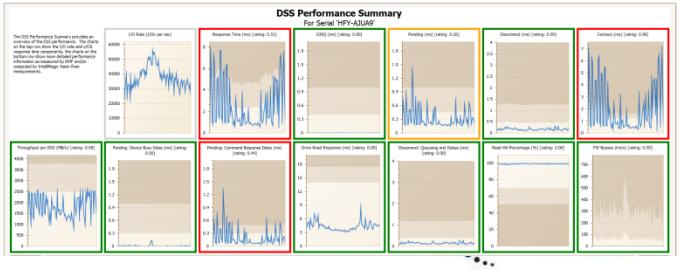
Healthy

GBs of RMF data on:
Processors, Storage, WLM,
Channels, FICON Directors,
GDPS replication, SRDF,
Coupling Facility, XCF, …

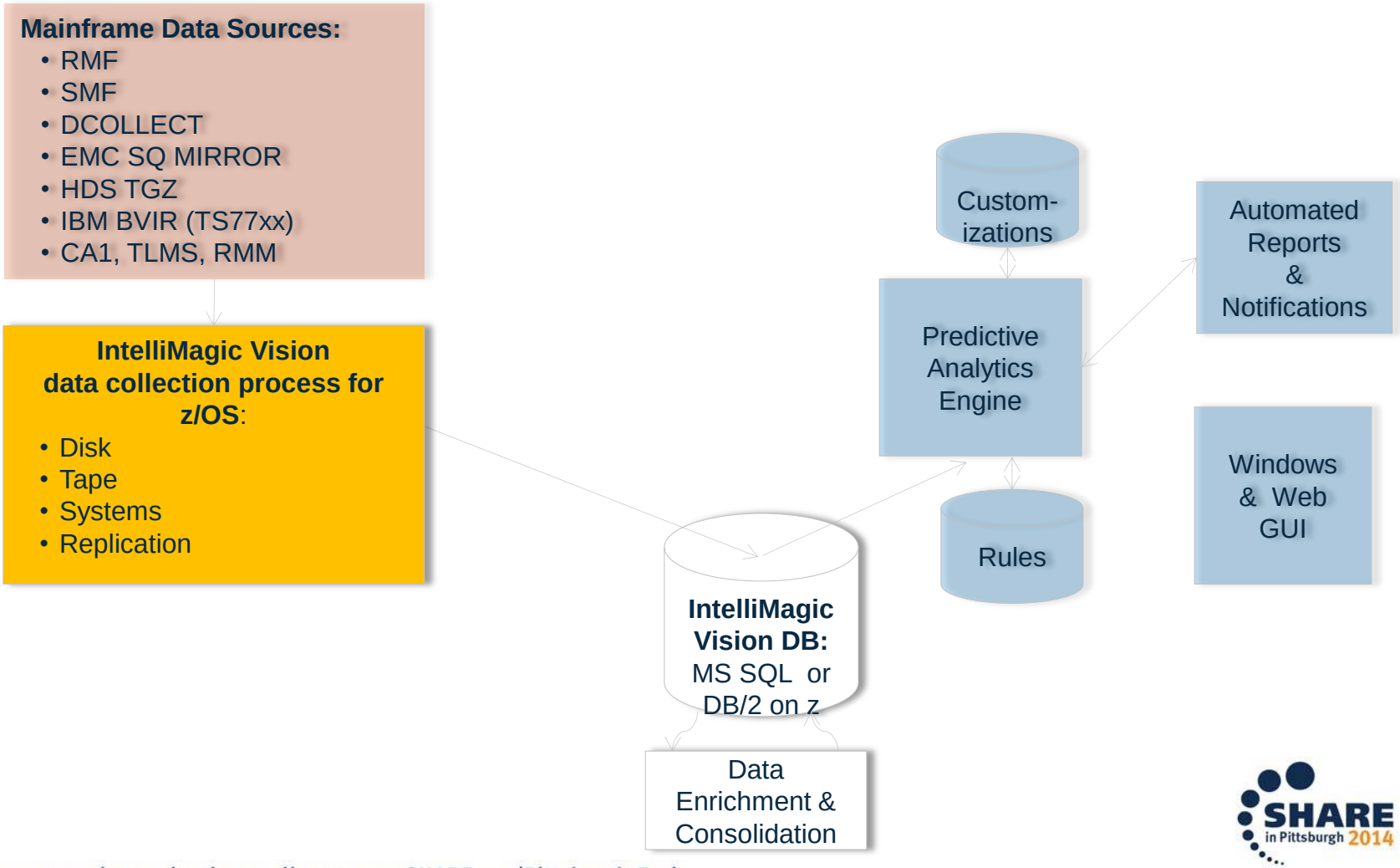


Dashboards with Key Risk Indicators

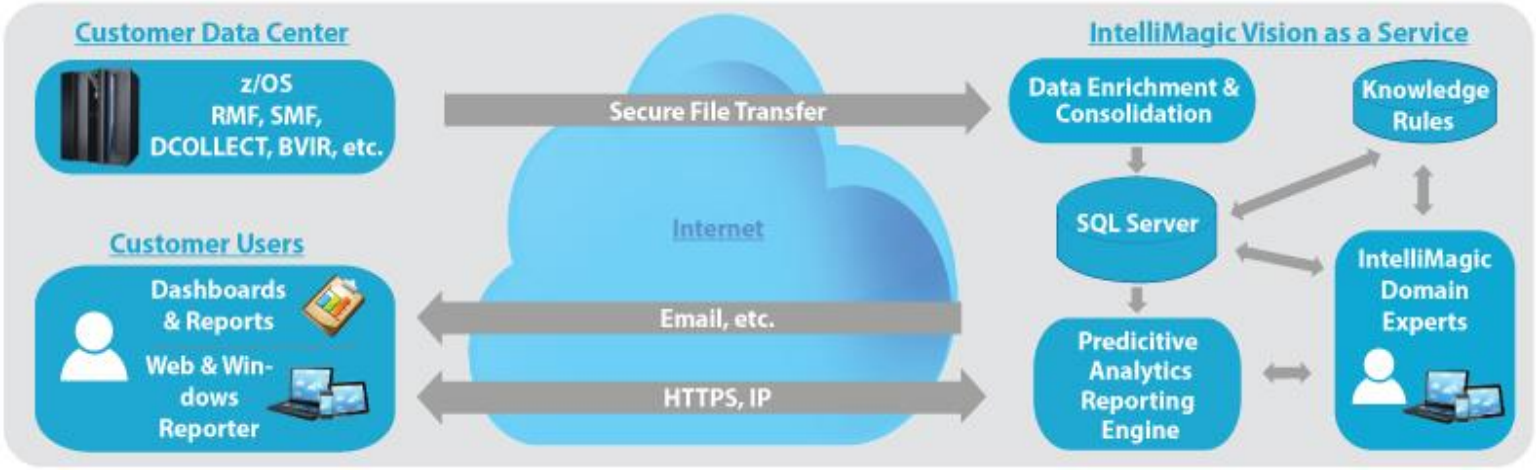
Quick drill downs
to show
underlying issues



IntelliMagic Vision Architecture



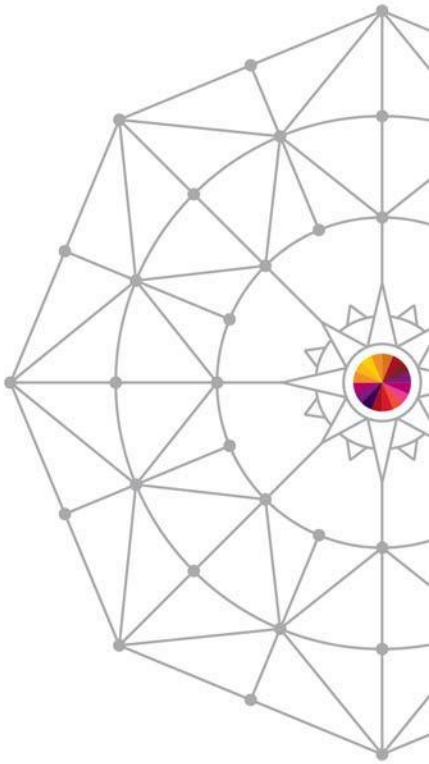
IntelliMagic Vision as a Service



Why z/OS Infrastructure Analytics in the Cloud?

- Fastest path to obtain analytics – *e.g., 24 hours*
- Low risk commitment – *e.g., 3 month engagement*
- Quickest knowledge transfer
- Easiest maintenance, latest features immediately, etc.
- Access to product experts seeing similar environments

Case Studies



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zHPF

Examples of what IntelliMagic can do to help you in your zHPF decisions and evaluation.

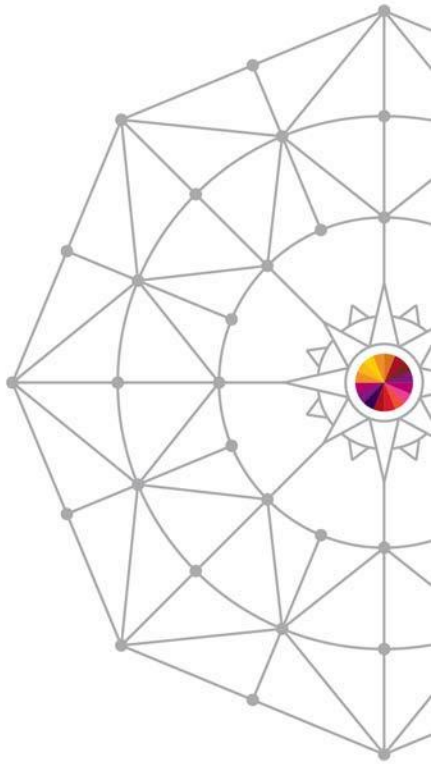
zHPF Case Study 1: Analyze current workloads and:

- Estimate percentage of zHPF candidate I/Os by DSS (using IntelliMagic Vision)
- Recommend channel consolidation to use fewer channels due to zHPF (using zCP3000)
  - Applicable when doing CEC consolidation and/or when upgrading or consolidating DSS

zHPF Case Study 2: Analyze current workloads and:

- Measure before/after impact on your workloads when zHPF is turned on (using IntelliMagic Vision)

zHPF Projections



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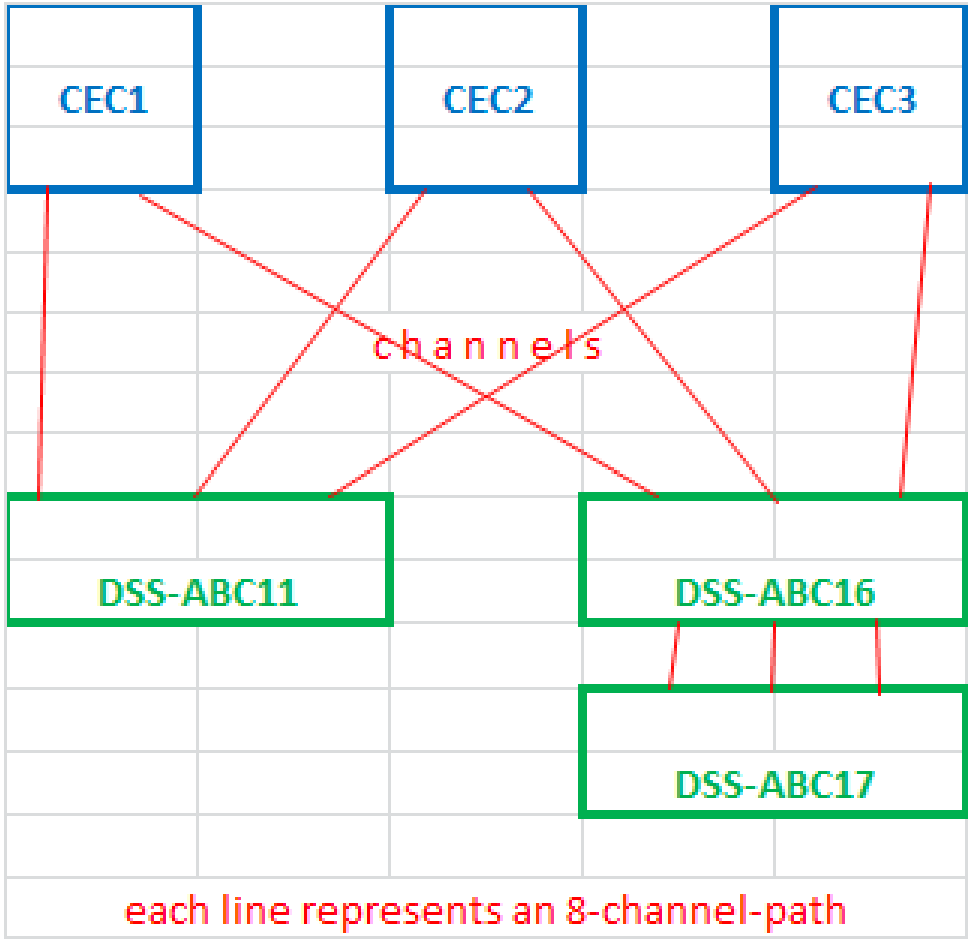
Data Analyzed

- SMF data type 42 and RMF type 70-78
- One day of SMF data was analyzed

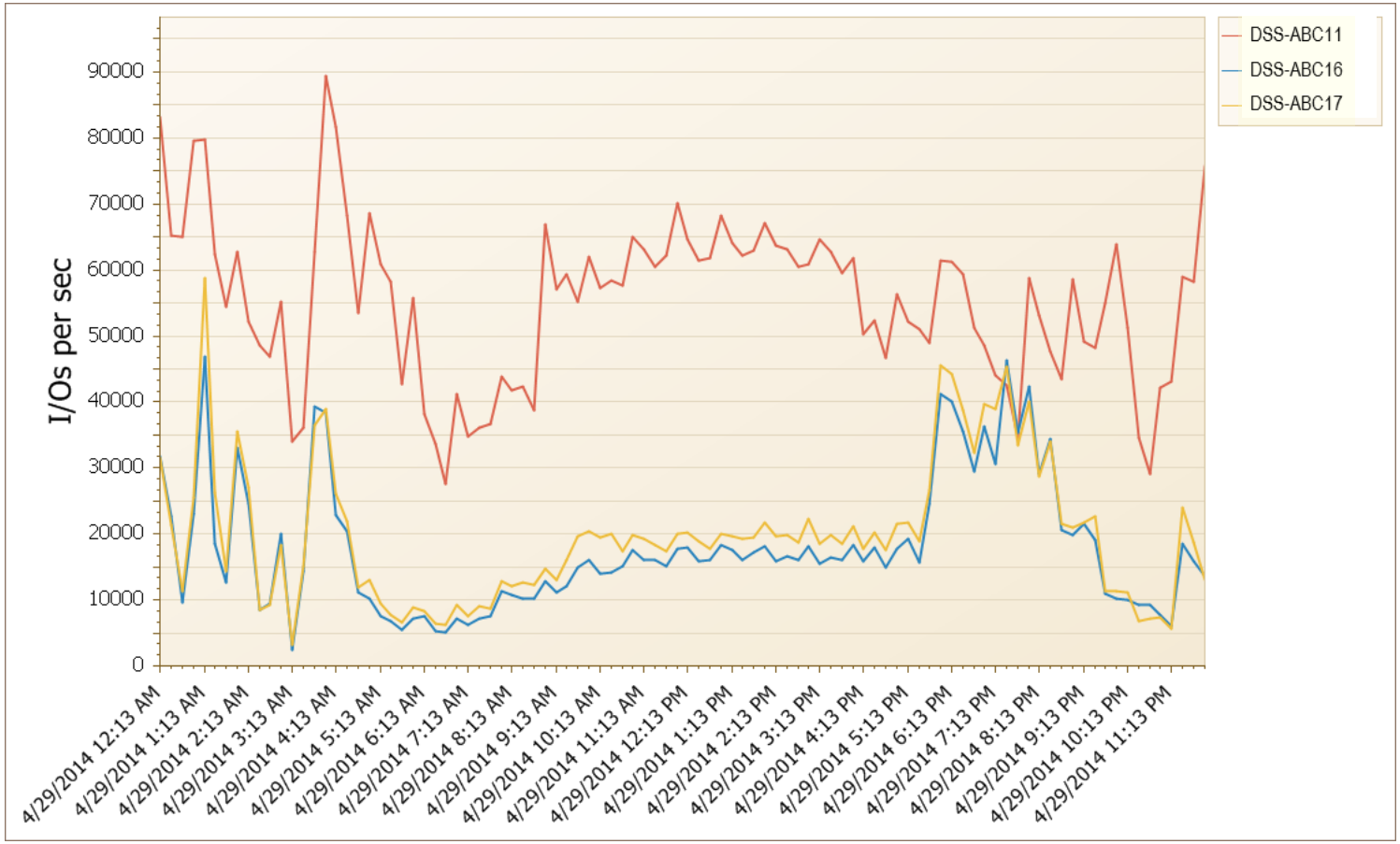
Current CEC to DSS Connection

3 CEC
CEC1, CEC2 &
CEC3

3 DSS
ABC11, ABC16
& ABC17

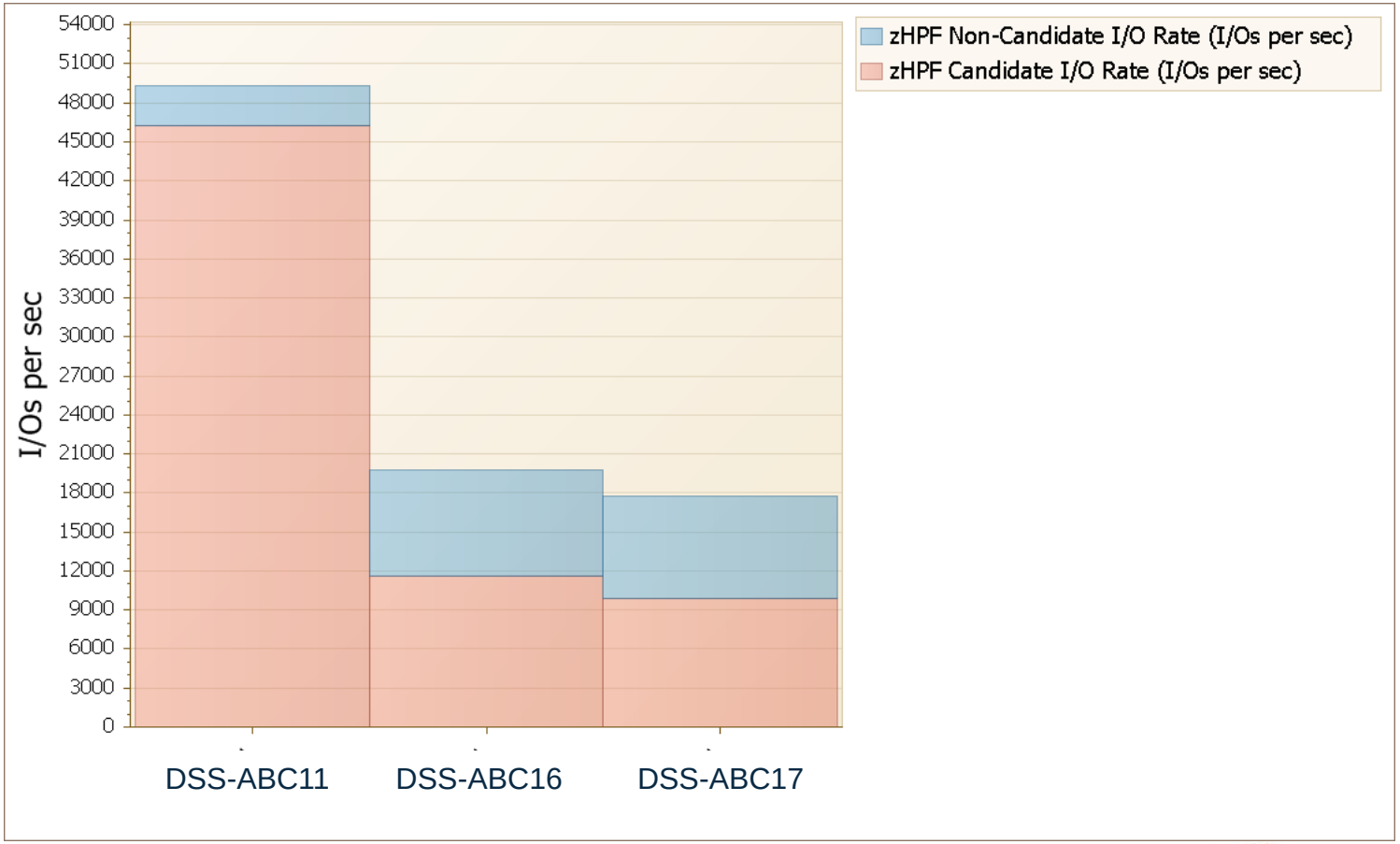


I/O Rate by DSS



zHPF Candidate I/O Rate by Day

The zHPF Candidate I/O Rate is calculated based on zHPF Phase 1 capabilities.



% zHPF Eligible I/O

The % zHPF eligible I/O depends upon the type of I/O

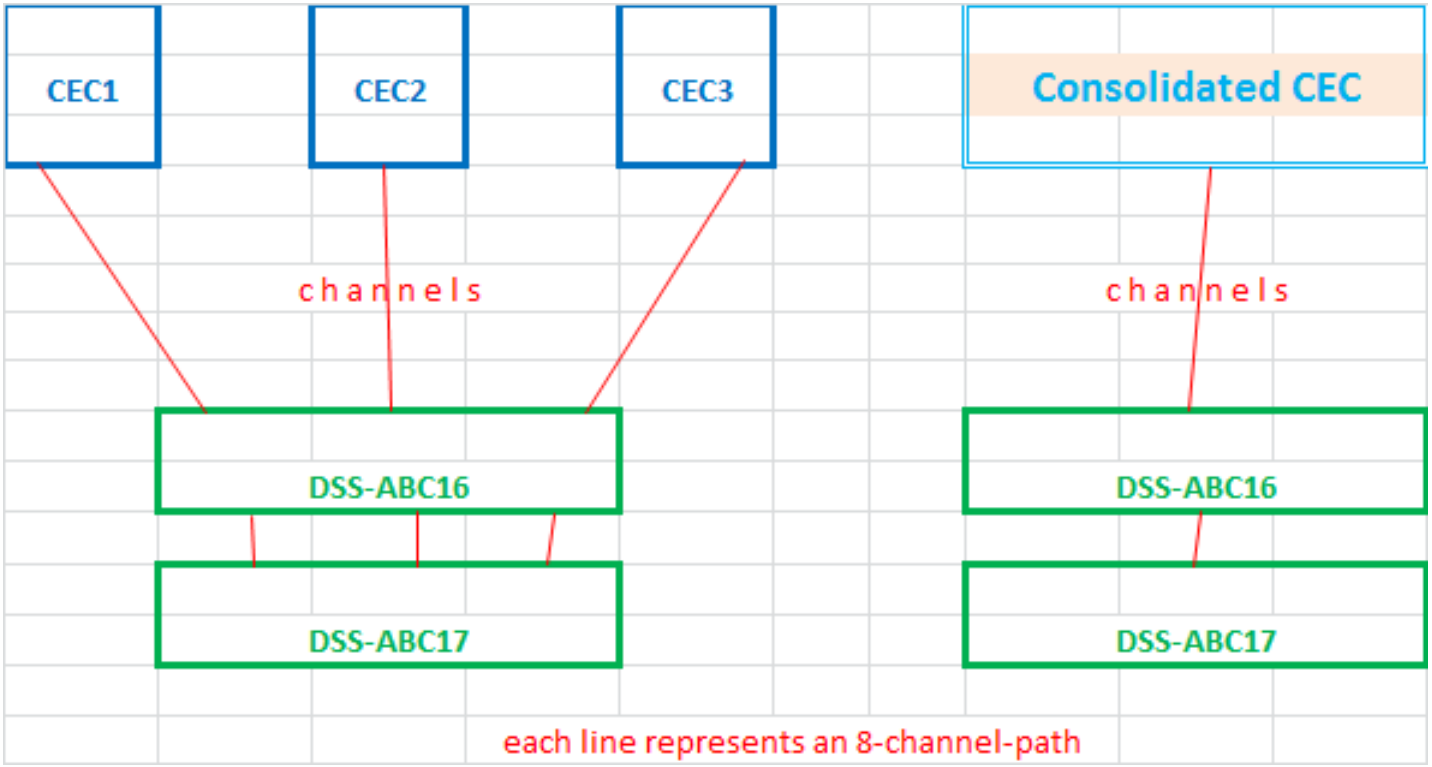
DSS	zHPF Candidate I/O Rate	Average I/O Rate	% zHPF I/O
ABC11	46,228	55,407	83%
ABC16 + ABC17	21,506	37,847	57%

Desired Channel Consolidation

Is it safe?

The 3 CEC will be consolidated to 1 CEC.

3-to-1 channel consolidation



CHPID Configuration

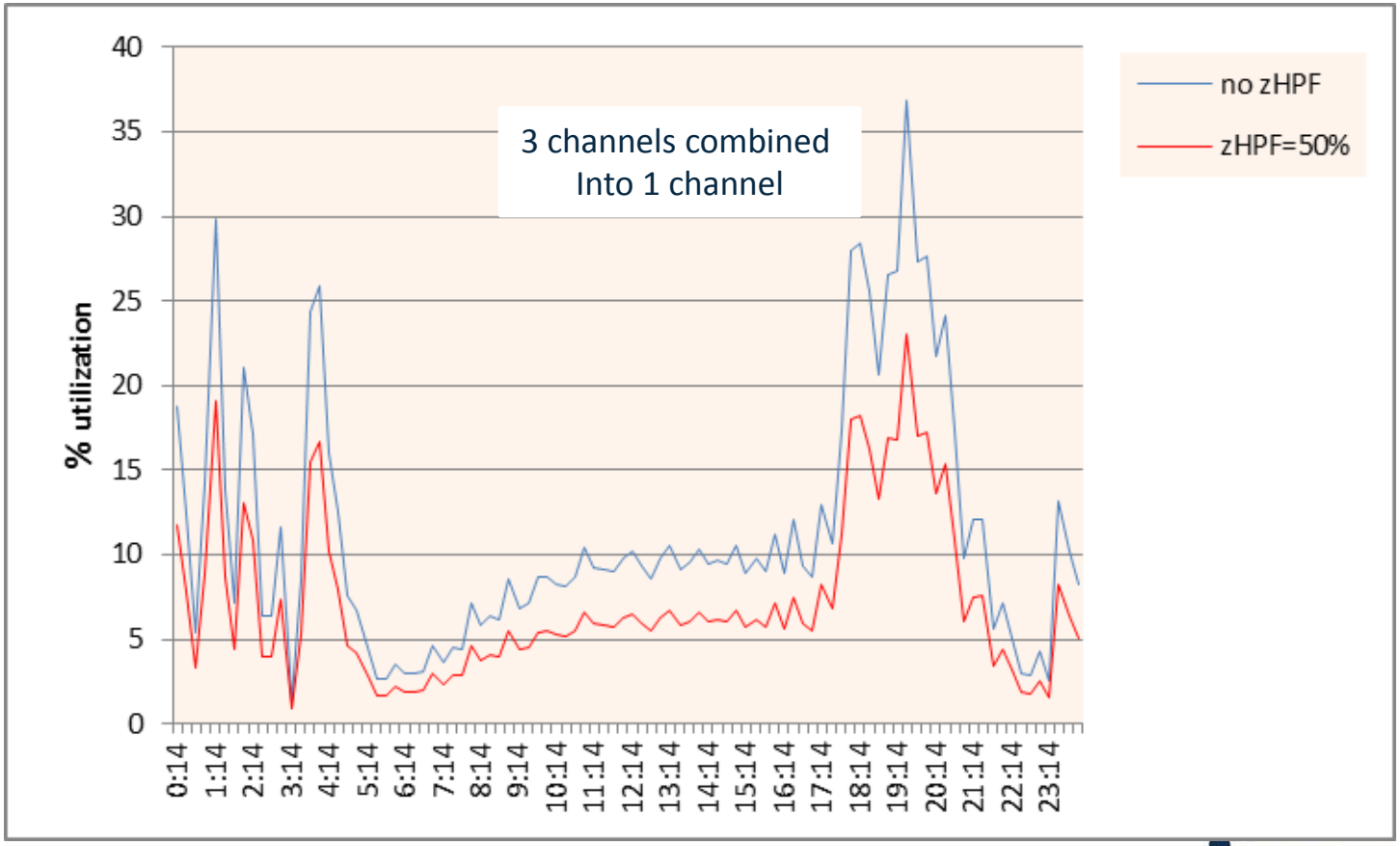
- CEC1, CEC2 & CEC3 accesses DSS-ABC16 & DSS-ABC17 through the following CHPIDs
  - 18 through 1F
- Consolidation suggestion
  - Combine each CHPID (18 – 1F) from each CEC onto 1 CHPID on the new CEC
    - This will be a 3-to-1 channel consolidation
    - The new CEC will access the 2 DSS through one 8-channel-path
- Activate zHPF

Channel Consolidation
Projection based on 50% zHPF Eligible I/O

Peak CHPID utilization:

Without zHPF=37%

With zHPF=23%

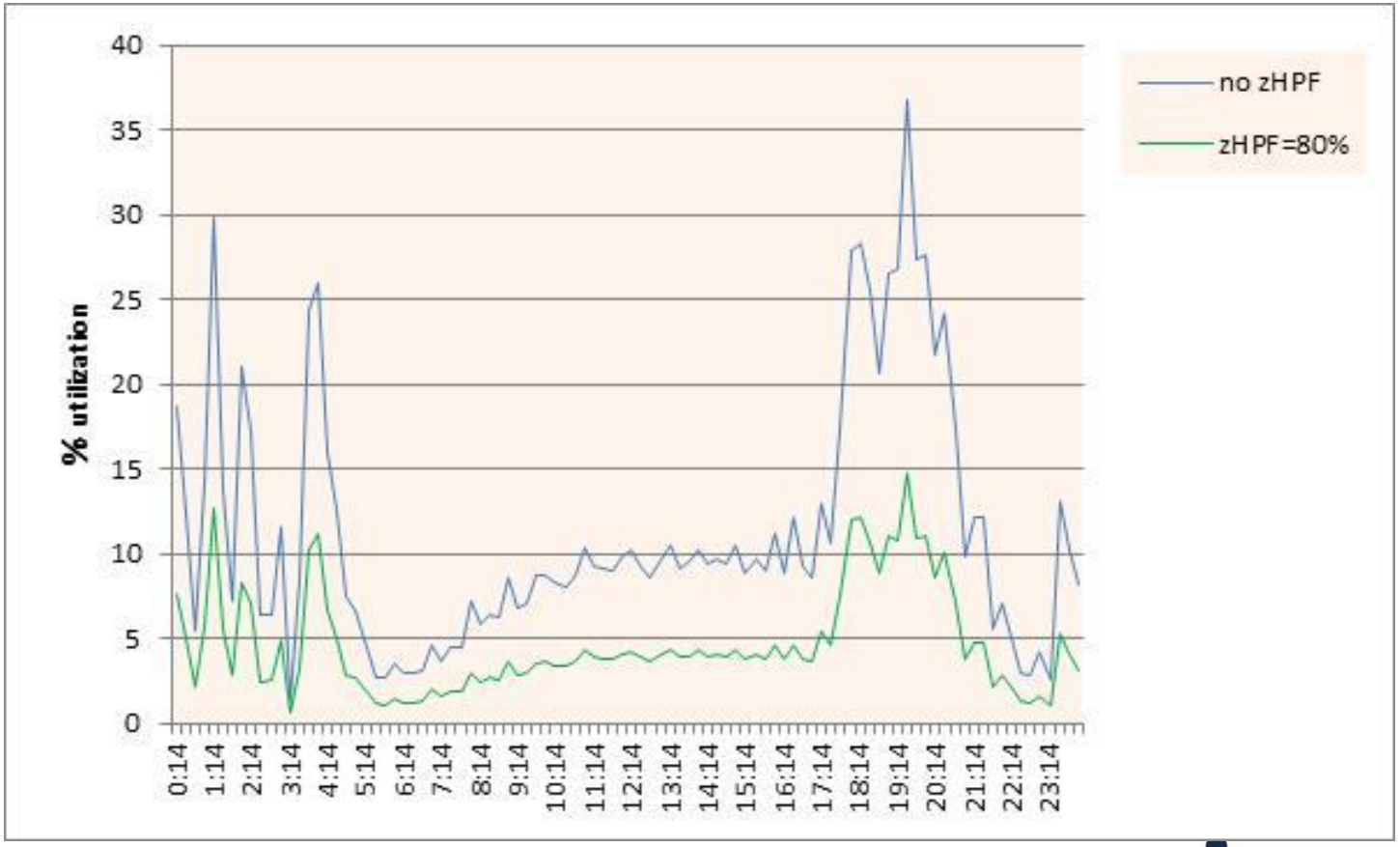


Channel Consolidation
Projection based on 80% zHPF Eligible I/O

Peak CHPID utilization:

Without zHPF=37%

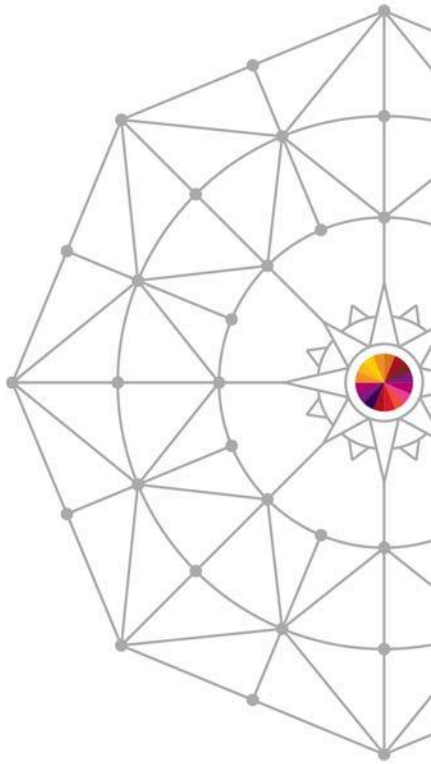
With zHPF=15%



zHPF Projection Study Results Summary

- With zHPF active at 50% zHPF eligible I/Os, the 3-to-1 channel consolidation shows the following:
  - Peak channel utilization improves from 37% without zHPF to 23% with zHPF active
- If the workload on ABC16 & ABC17 have the same characteristics as the workload running on ABC11, with an 80% zHPF eligible I/Os the consolidation shows the following:
  - Peak channel utilization decreases by more than half, from 37% to 15%
- zHPF will allow the configuration to safely use fewer of channels.

zHPF
Performance Analysis



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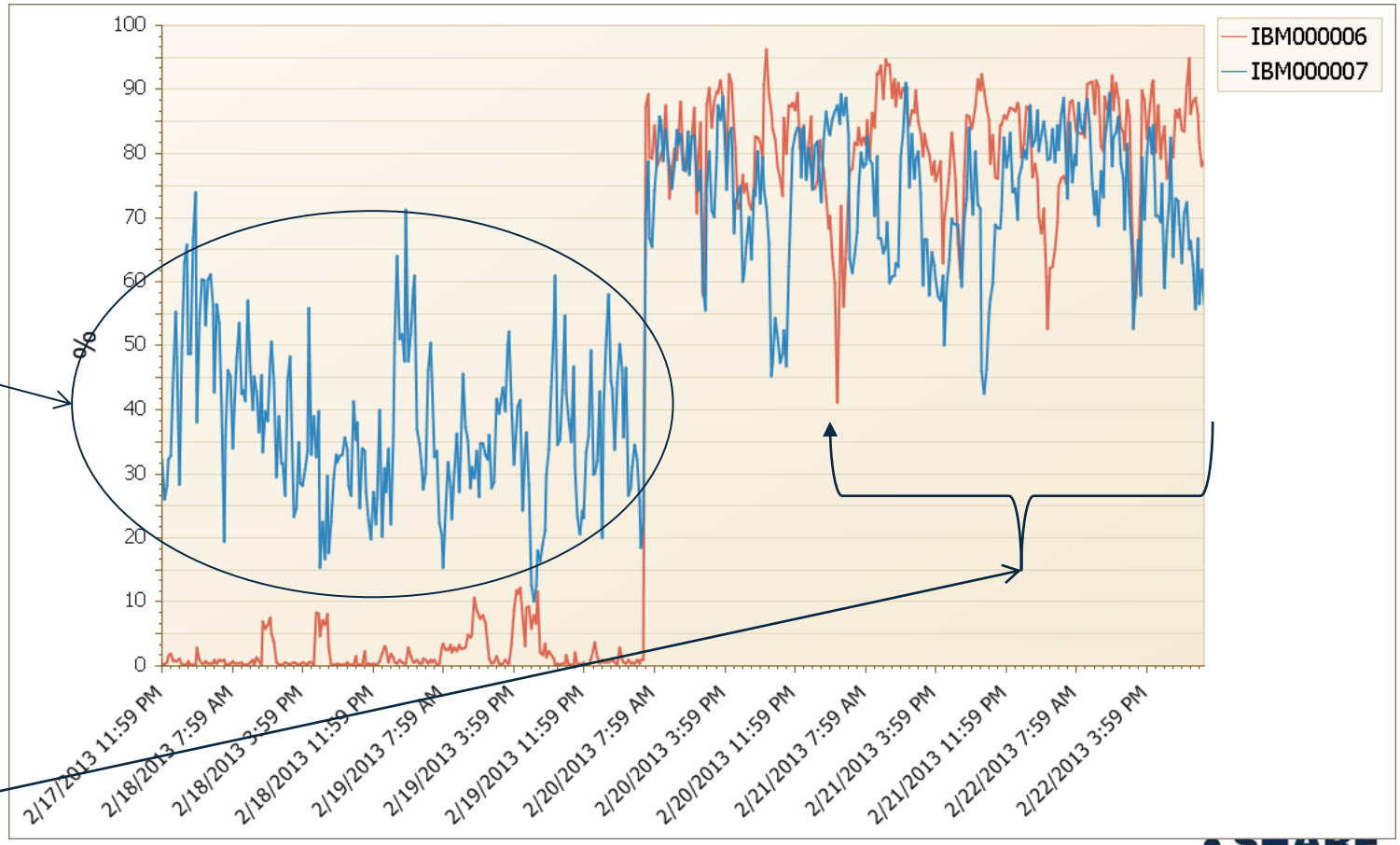
zHPF Usage (%)
for all Channels by Processor Complex serial

One LPAR enabled zHPF prior to zHPF cutover

48 hour zHPF Usage:
Avg = 78.4%
Min = 41%
Max= 96%

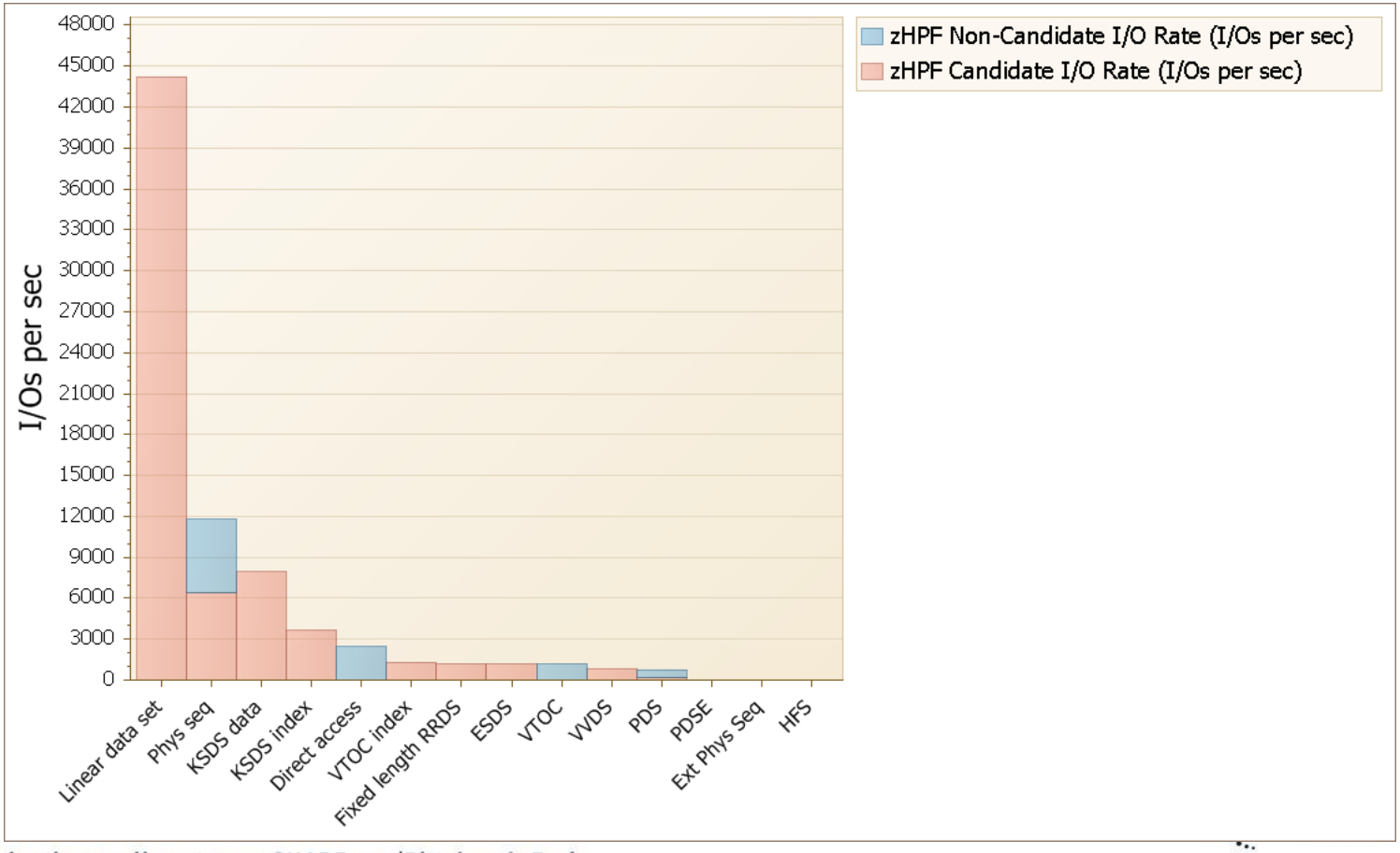


zHPF candidate and non-candidate I/O requests by data set type

(I/Os per sec) 24 hour summary for all datasets by DSN type

97% IOs captured in data set records (T42).

zHPF Pct:
87.5% T42
87.4% T74.5
86.4% T73
(zVM IOs excluded)



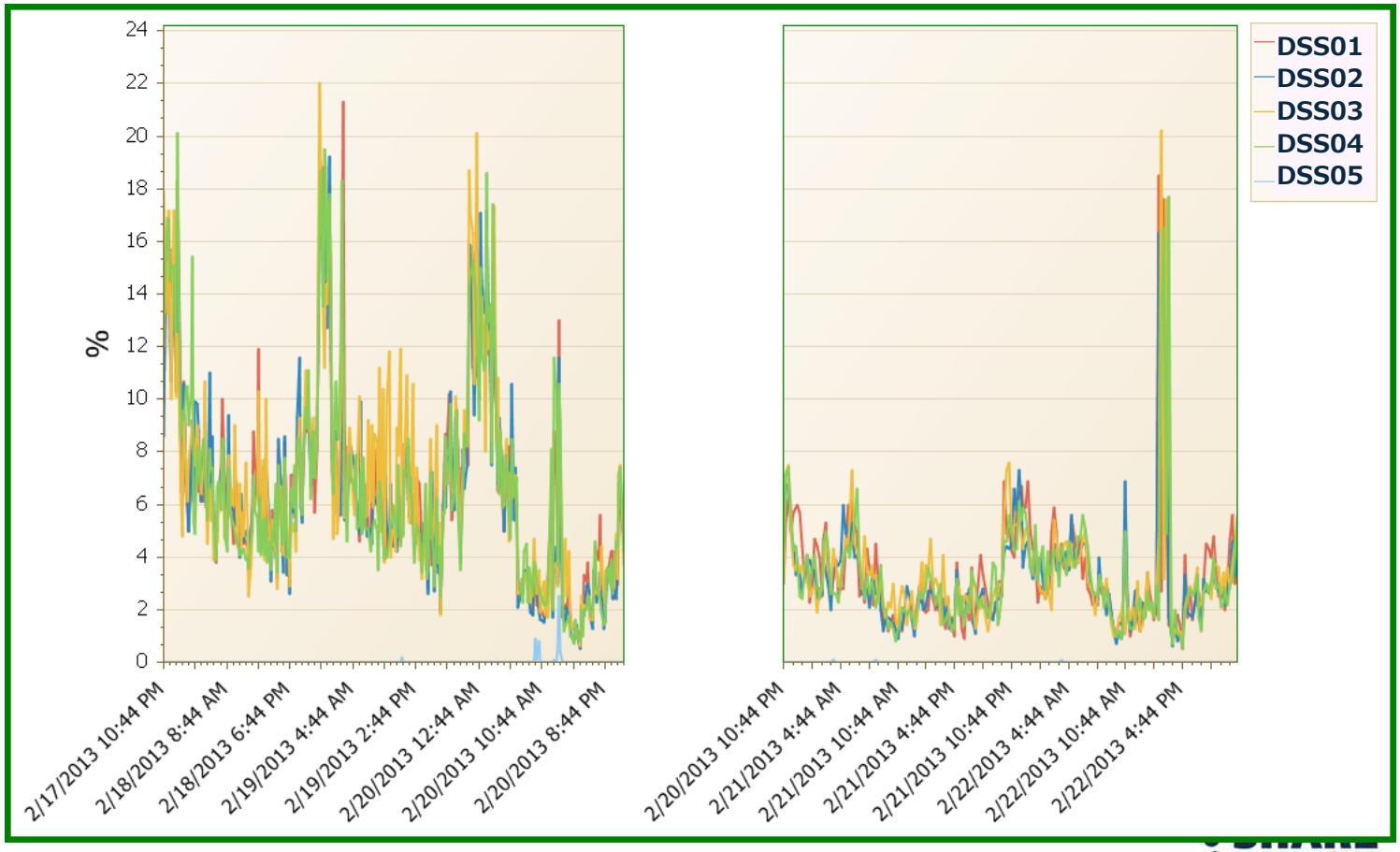
Channel Comparison

Microprocessor Utilization for busiest channel connected to DSS

For Processor Complex serial 'IBM000006' by DSS List
Rating based on Channel data using System Thresholds

Using just the CEC with little zHPF prior to the cutover channel u-p util 53% lower on 48 hour avg.

Peak is still close as high as ever but it's an afternoon spike. Absolute maximums still modest (20%).

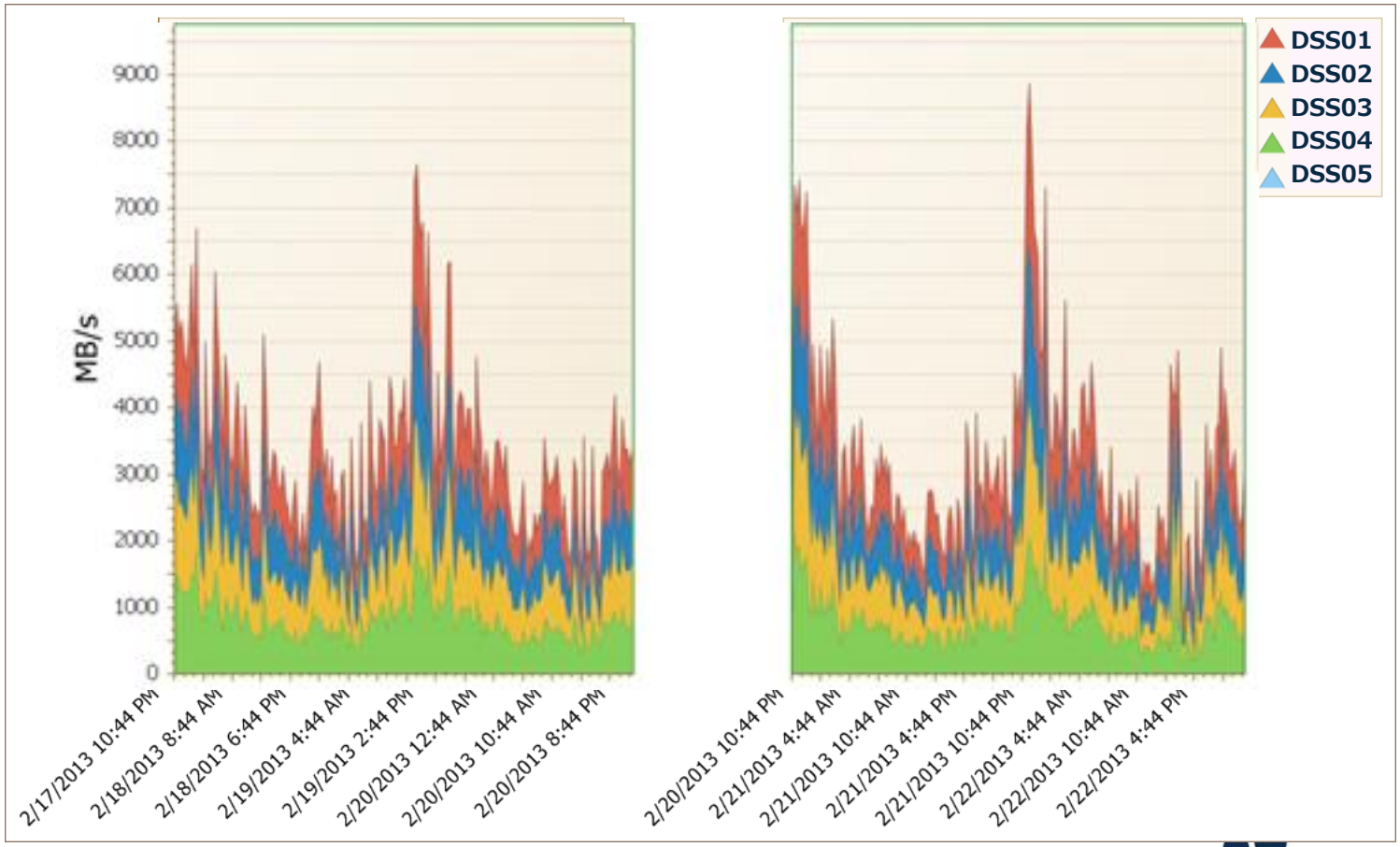


Disk Storage System Comparison

Throughput per DSS (MB/s) for all Disk Storage Systems by Serial

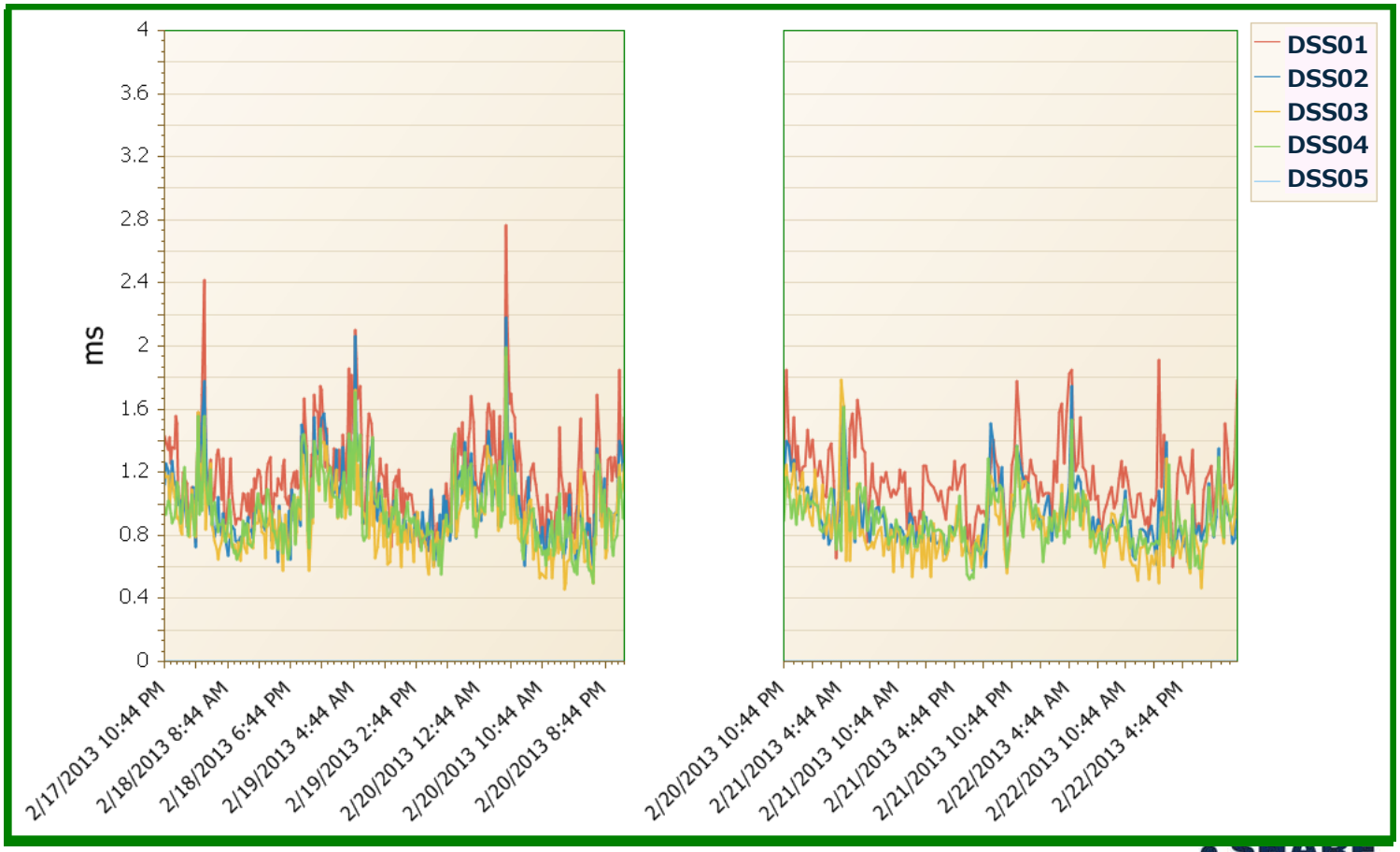
Rating based on DSS data using DSS Thresholds

Max thruput for 15min interval increased by 15.8% on 48 hour avg.



Response Time (ms)
for all Disk Storage Systems by Serial
Rating based on DSS data using DSS Thresholds

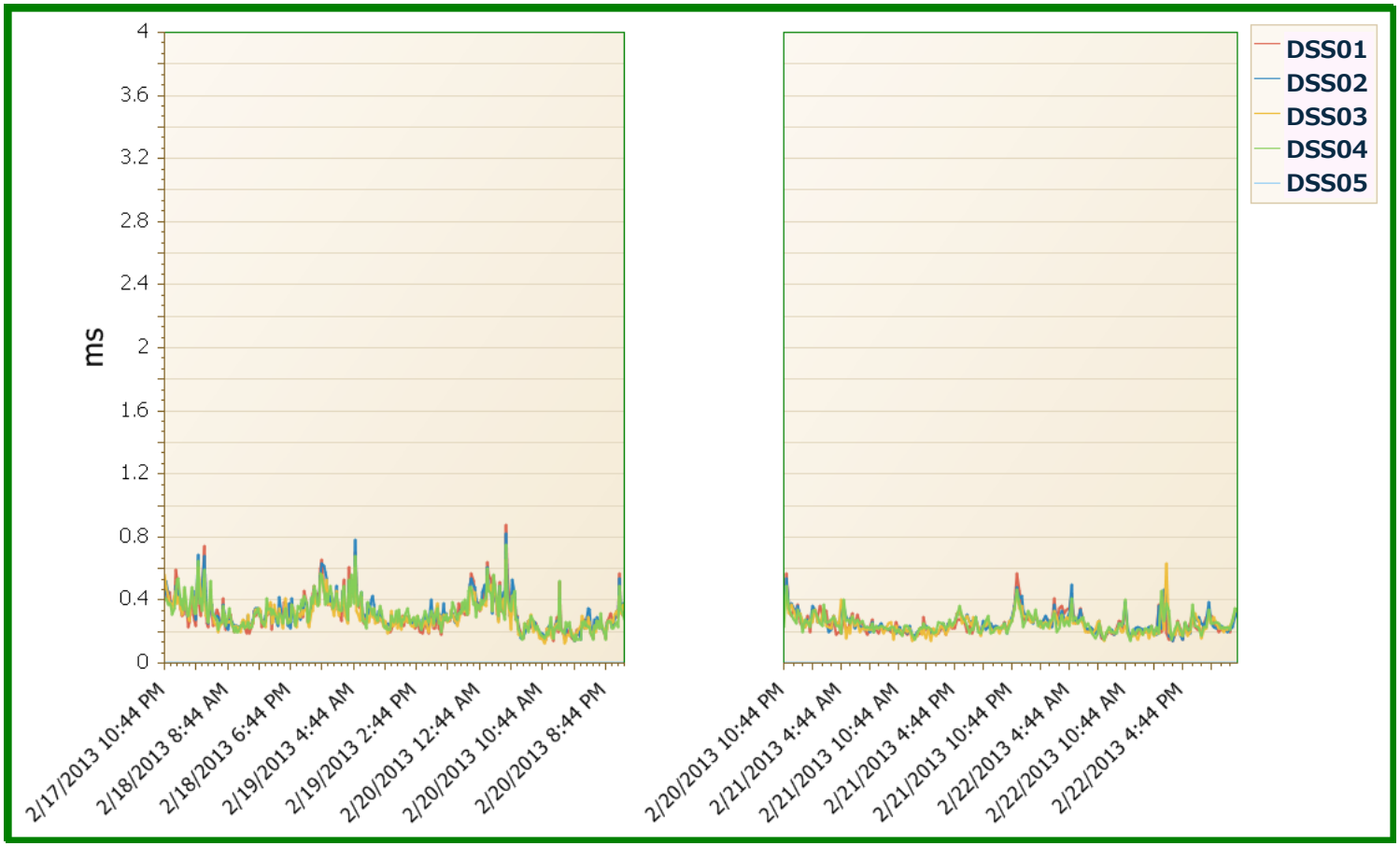
Average IO response time dropped 7.1% on 48 hour avg.



Connect Time (ms)
for all Disk Storage Systems by Serial

Rating based on DSS data using DSS Thresholds

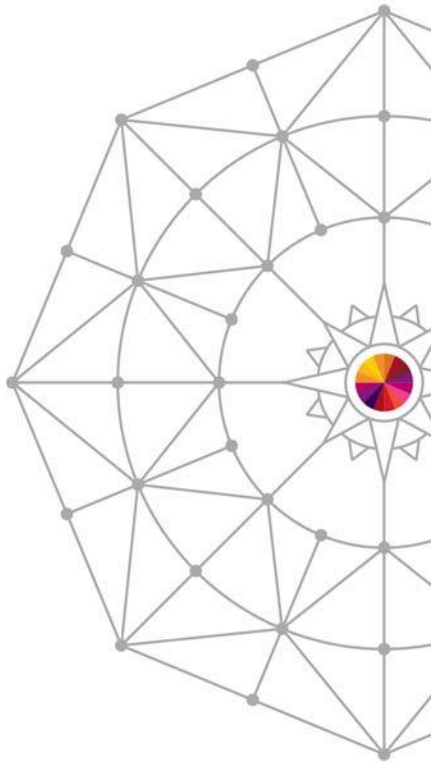
Average IO connect time dropped 24.9% on 48 hour avg.



zHPF Before & After Study
Results Summary

- zHPF penetration 78% of disk IOs
  - One year later - 24 hour avg was 86%
  - Good correlation between zHPF candidate and actual pct zHPF
- Channel u-processor utilizations reduction 53%
- IO Response Time Reduction 7%
- IO Connect time reduction 25%

Coupling Facility Problem Analysis



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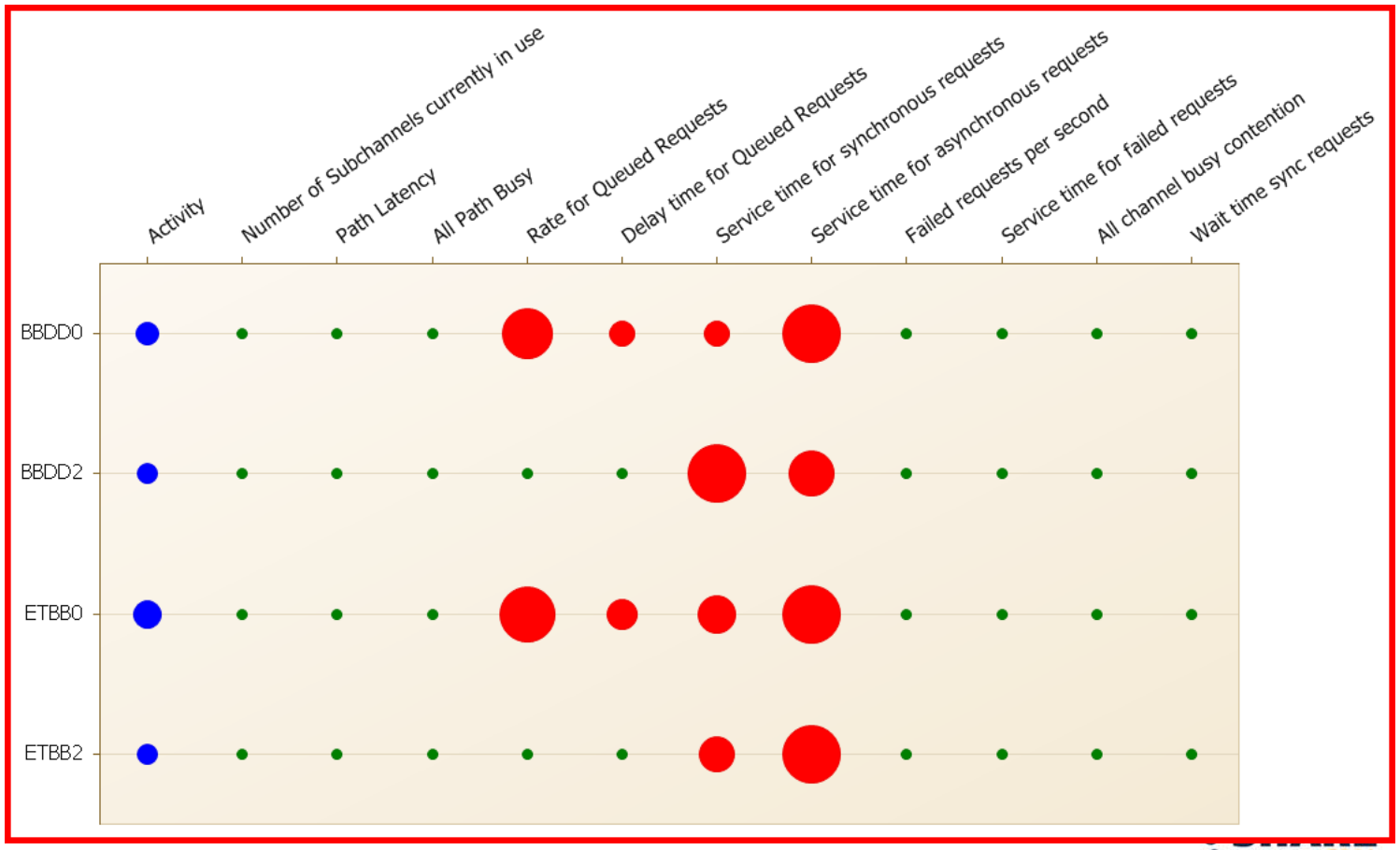
Coupling Facility

- CF has dedicated engine
- CF has shared processor
  - DYNDISP=YES|NO
  - DYNDISP=THININTERRUPT

Coupling Facility Path Contention for all Coupling Facility Locals by CF Name

Rating based on Coupling Facility Local data using Coupling Facilities

Logical CFs in use, Application performance meeting service levels yet Vision CF reports show excessive sync request service times



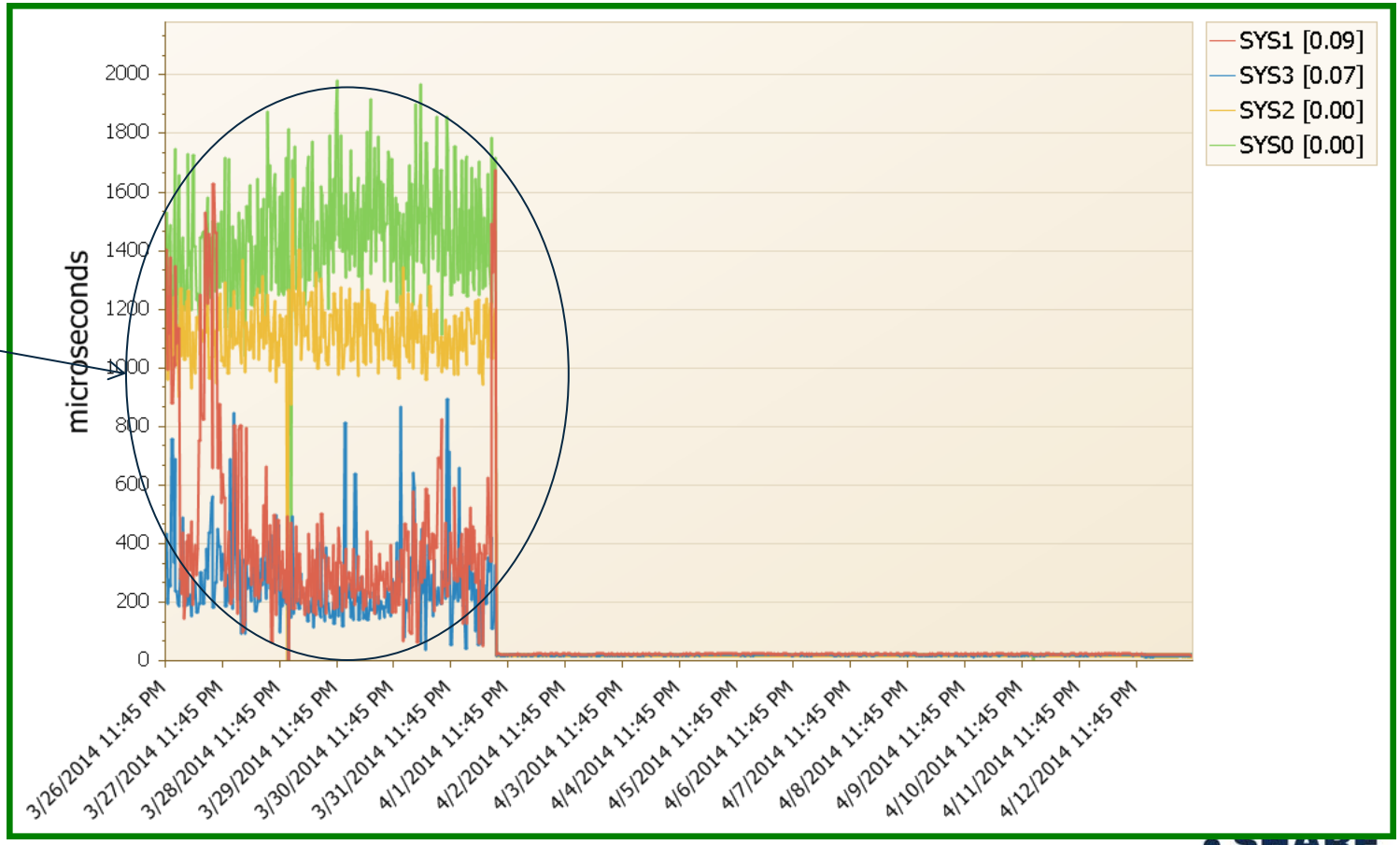
Coupling Facility System Mini-charts

The drill down from one logical coupling facility shows CF sync response times above 1000us.

The System charts show the usage of one coupling facility by all the connected systems. The charts show the number of requests from the systems, the service time for synchronous and asynchronous requests, and delays and contention.

Service time for synchronous requests
(microseconds)

For CF Name by System



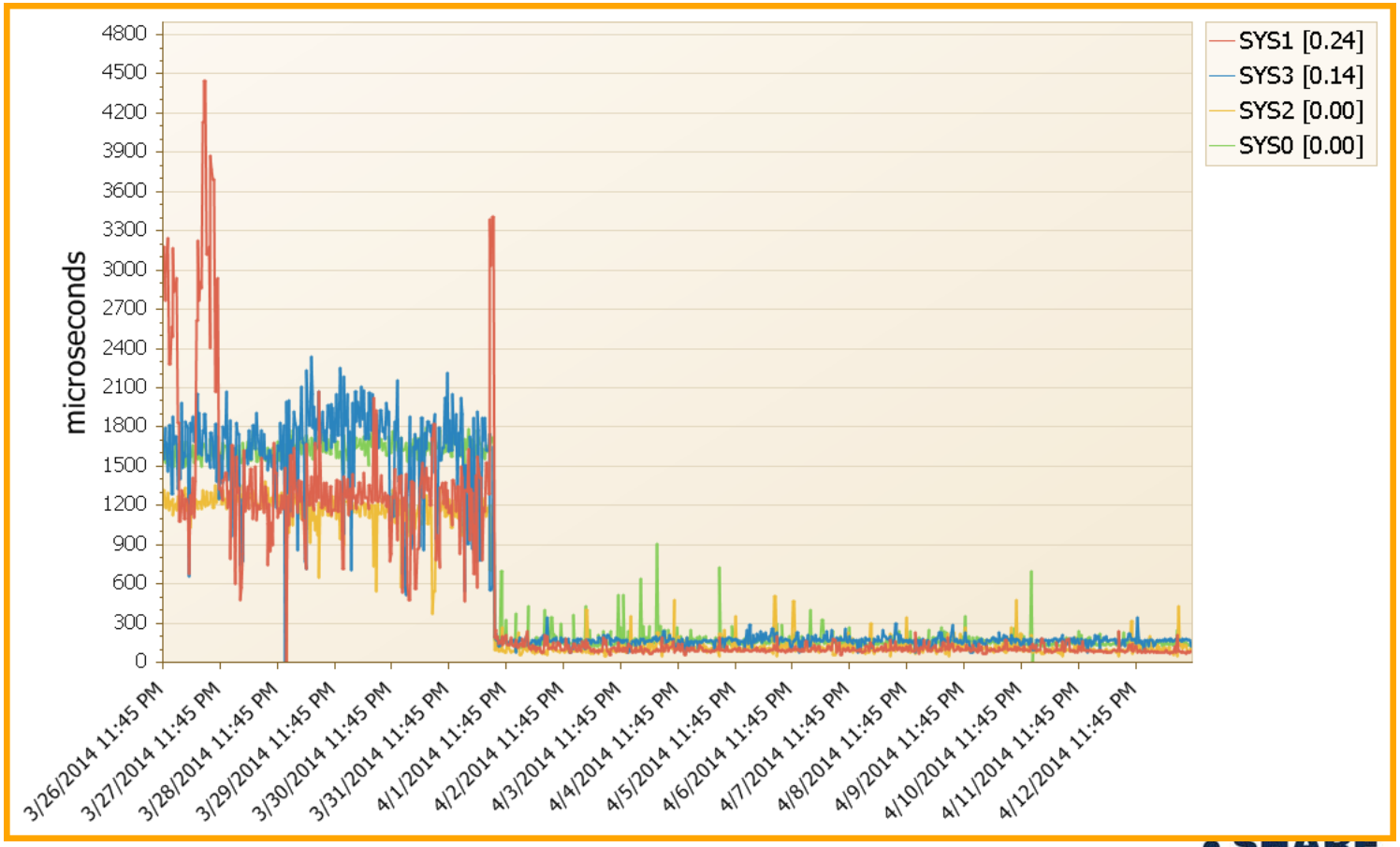
Added detail, drilling down from the multi-variable chart.

Note: slide includes times after dyndisp=thin.

Service time for asynchronous requests

(microseconds) [rating: 0.23]

For CF Name by System



CF Async response times were also high.

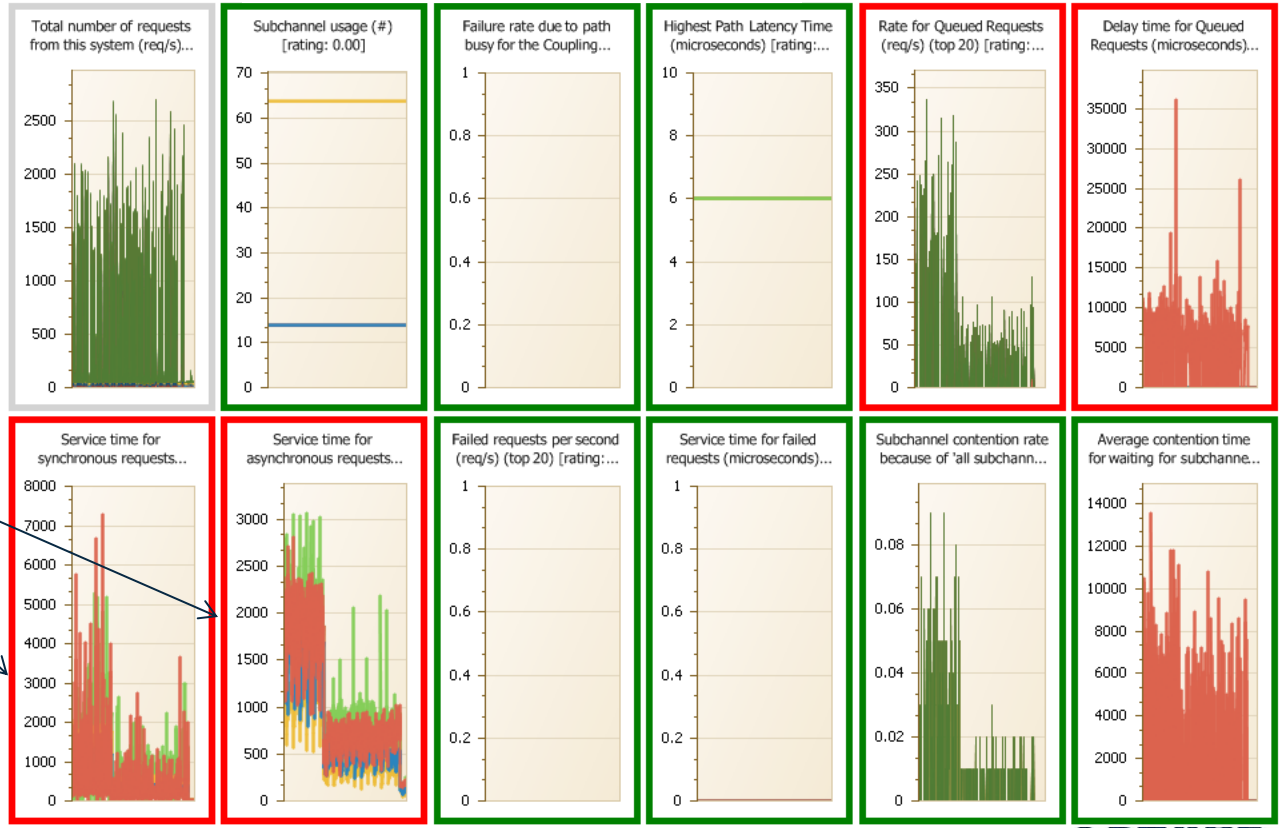
Note: slide includes times after dyndisp=thin.

Coupling Facility System Minicharts

“dyndisp=thin” on one Sysplex

For CF Name by System

The System charts show the usage of one coupling facility by all the connected systems. The charts show the number of requests from the systems, the service time for synchronous and asynchronous requests, and delays and contention.

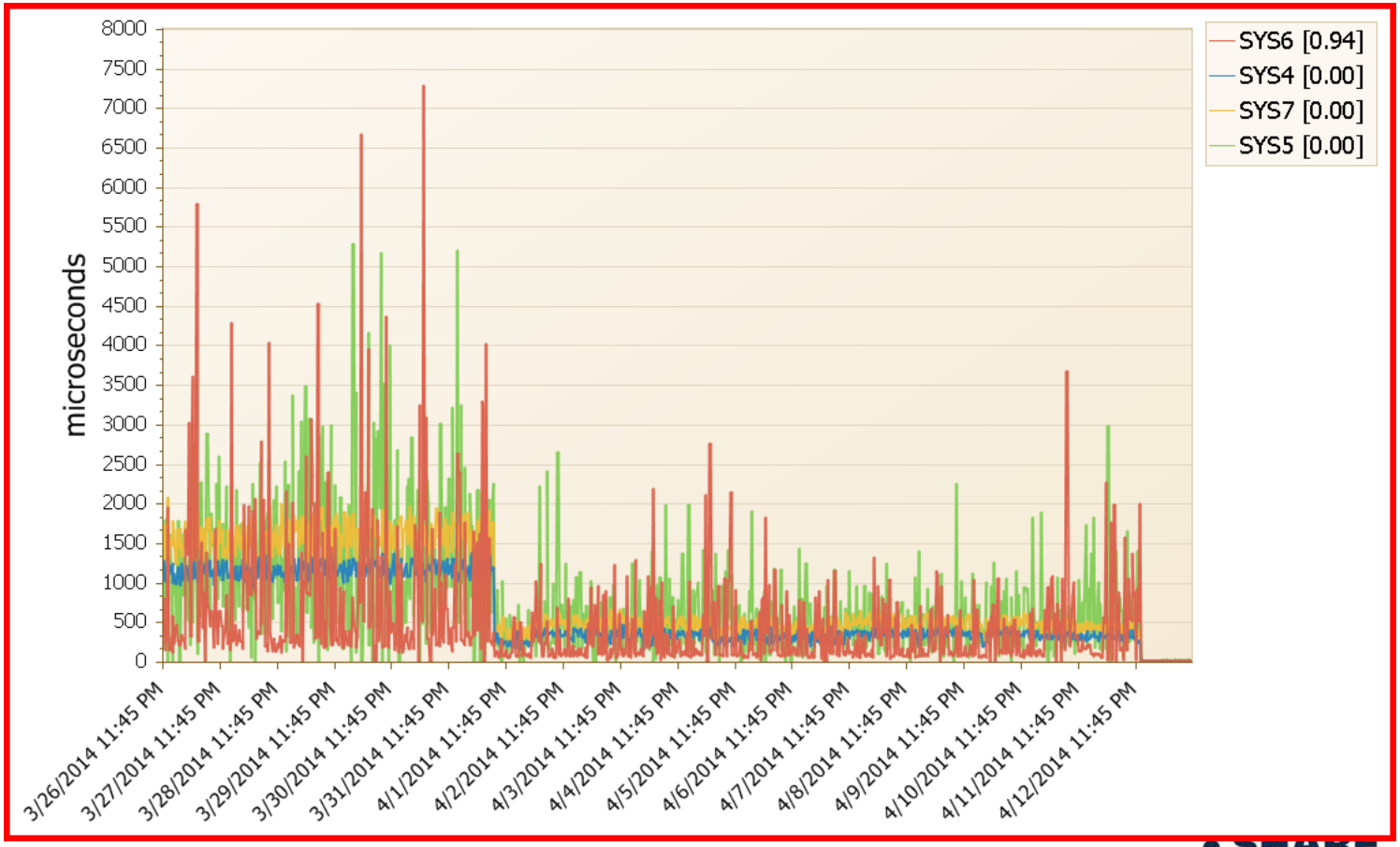


Partial implementation Showed great improvement in both sync and async service times for the 2 sysplexes yet to be converted.

Service time for synchronous requests

(microseconds) [rating: 0.92]

For CF Name by System

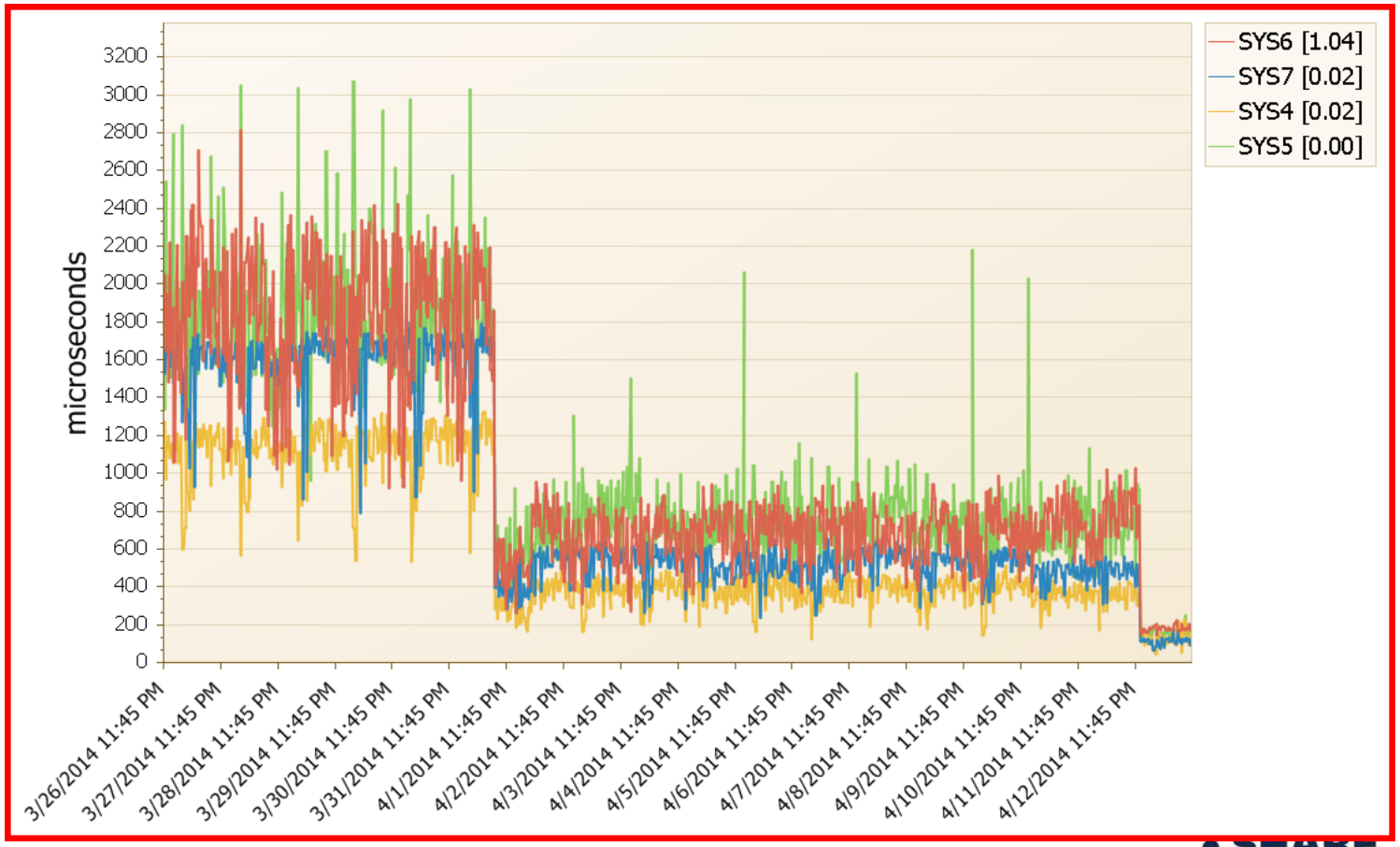


Added detail, drilling down from the multi-variable chart.

Service time for asynchronous requests

(microseconds) [rating: 0.50]

For CF Name by System



Added detail, drilling down from the multi-variable chart.

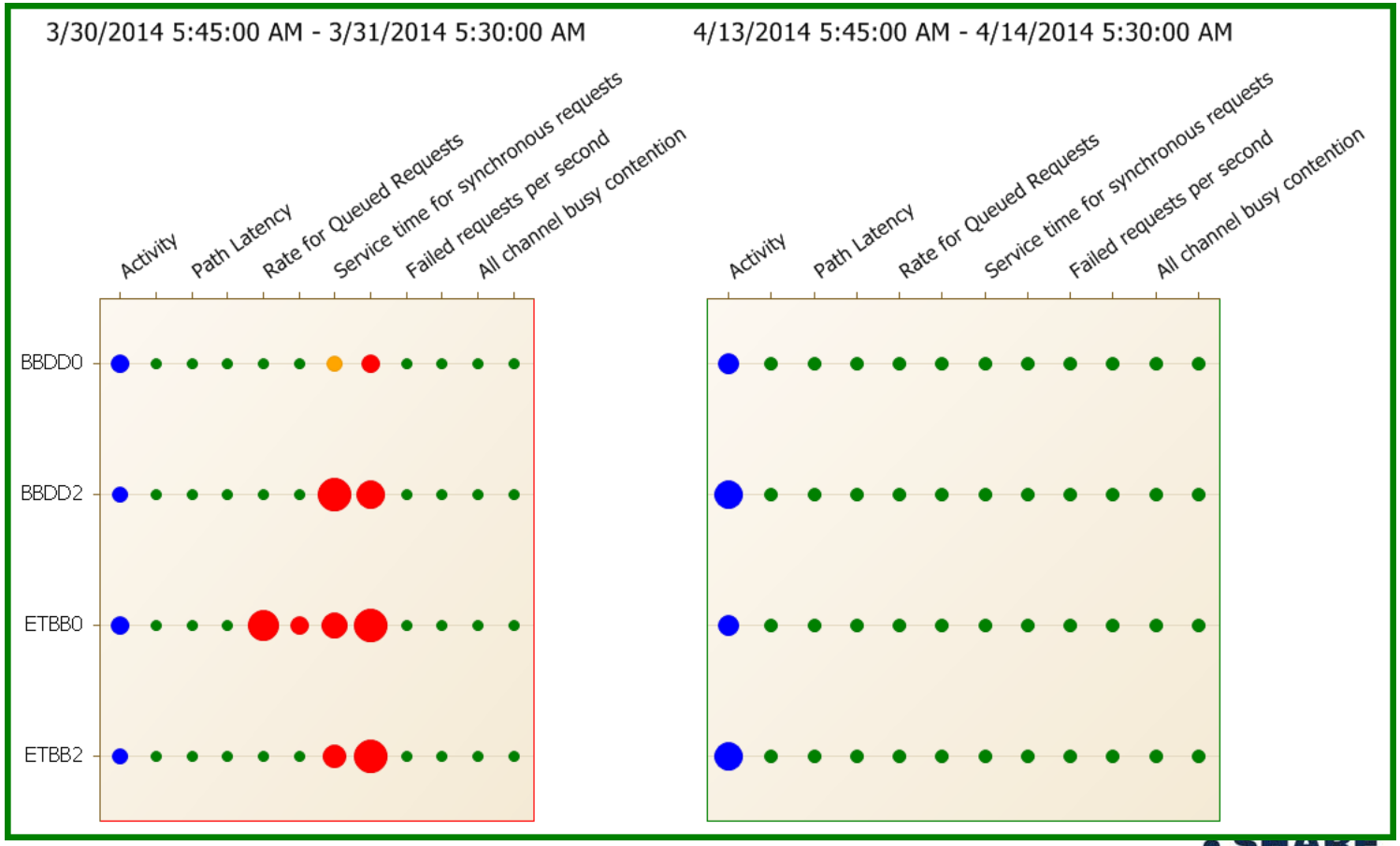
Coupling Facility Path Contention

[rating: 2.94 / 0.00]

for all Coupling Facility Locals by CF Name

Comparisons after full implementation of “dyndisp=thin”.

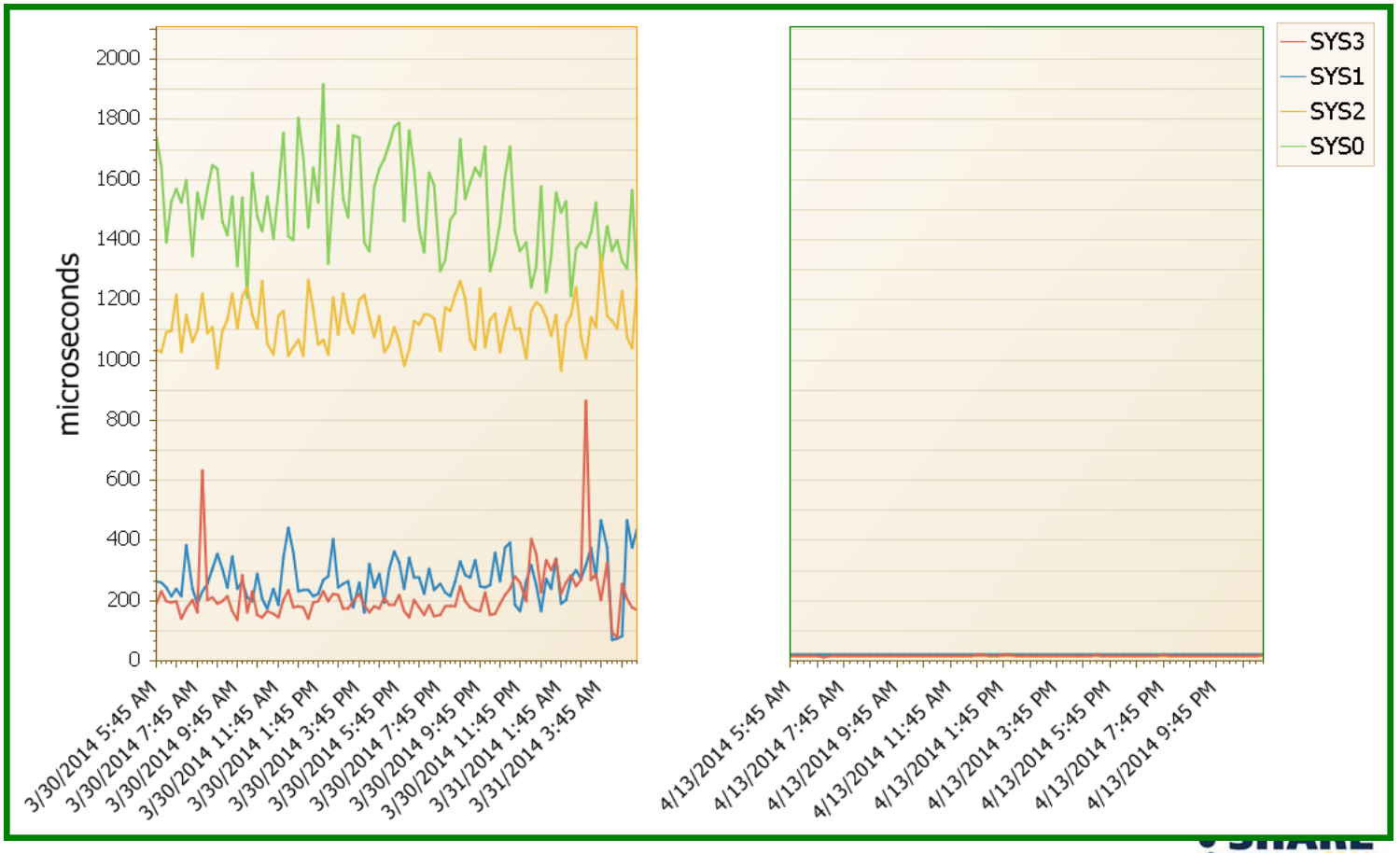
CF async service time also improved.



Service time for synchronous requests
(microseconds)

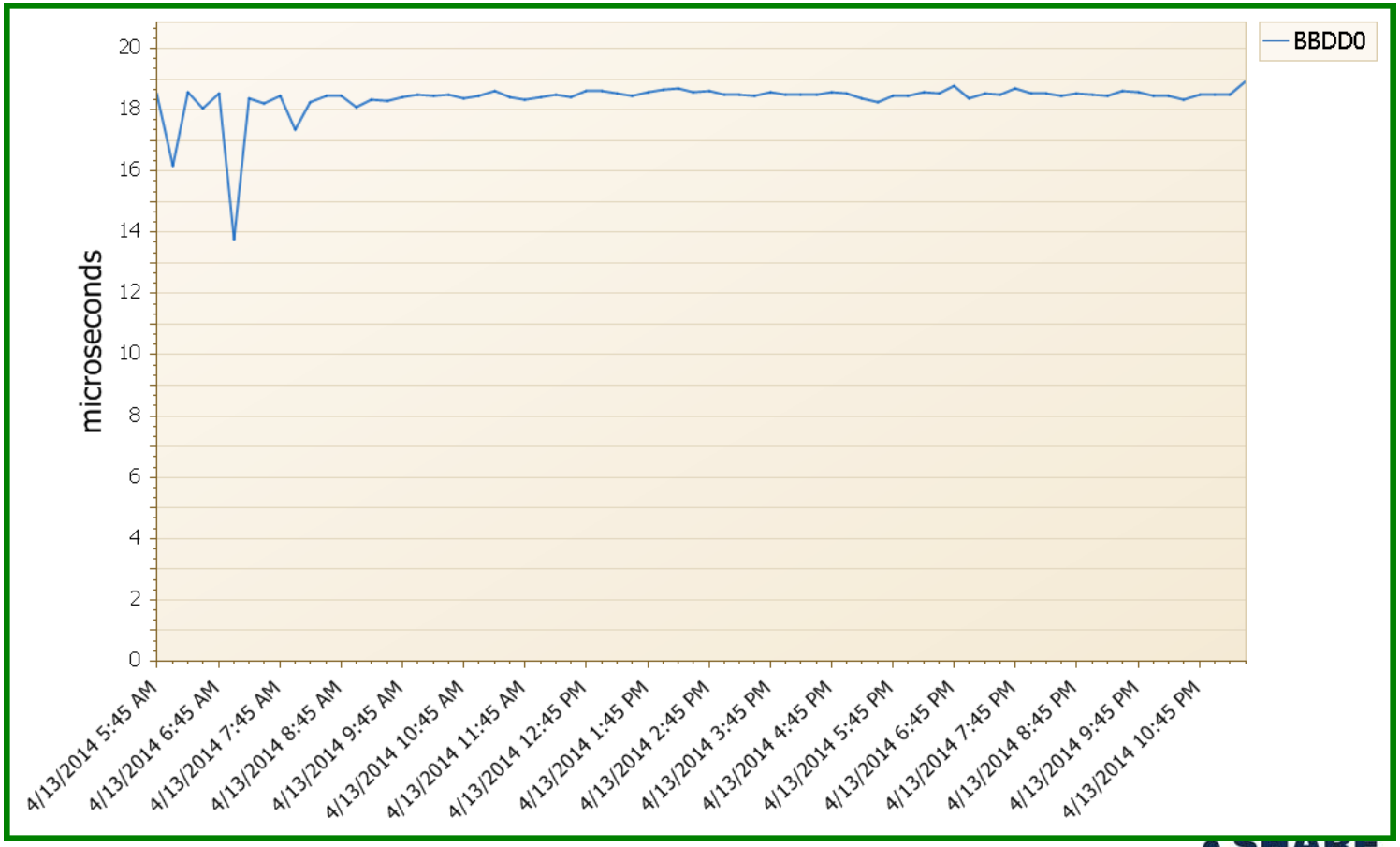
For CF Name by System

Side-by-side detailed before/after comparison.



Service time for synchronous requests
(microseconds)

For CF Name



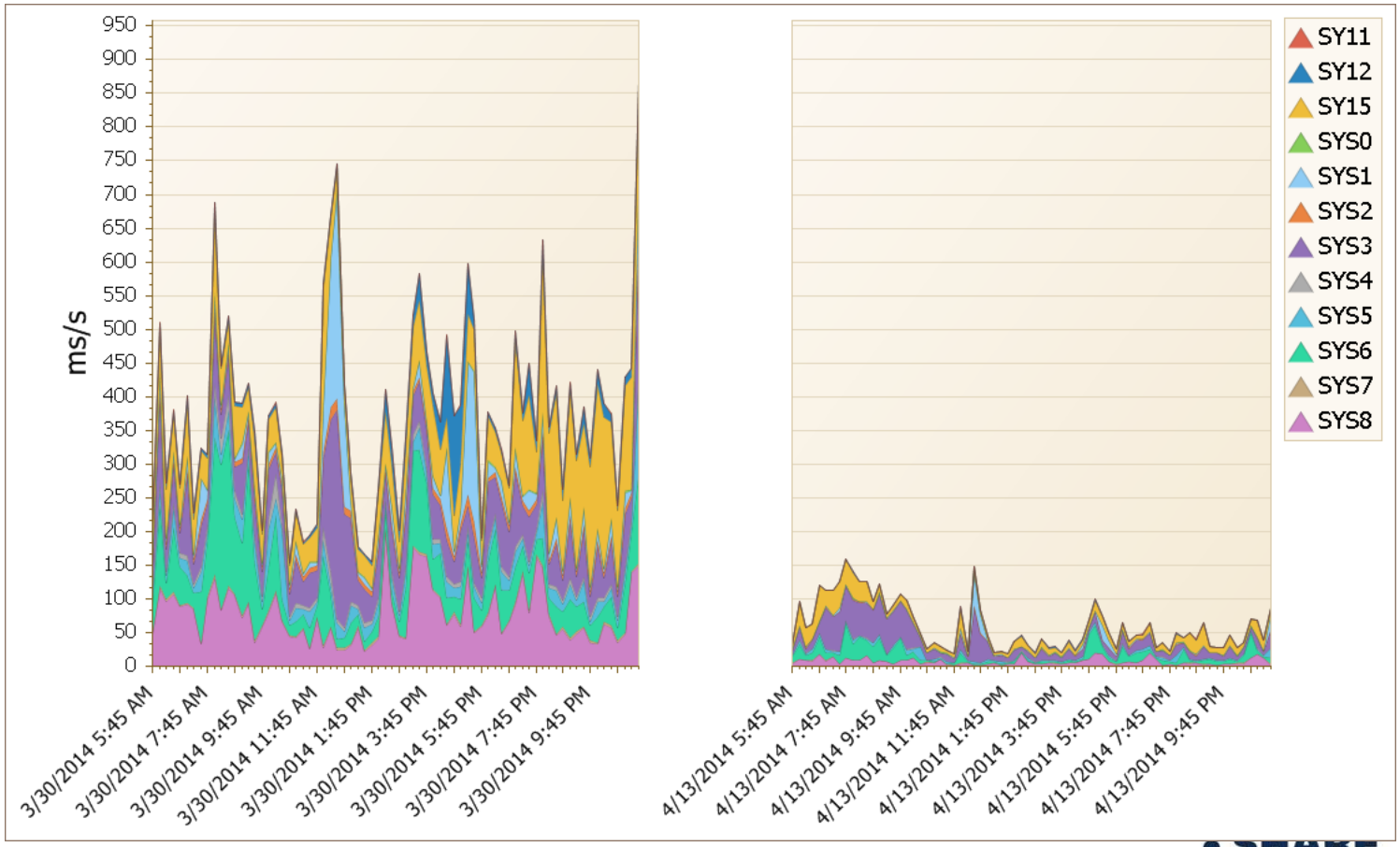
After dyndisp=thin logical CF sync service times are below 20us.

Average CP Usage for Sync CF Requests

(ms/s)

for all Coupling Facility Activity by System

Excessive CF sync service times used ~0.5 CPs. This CP savings can translate to delayed upgrades and/or lower software licensing fees.



Coupling Facility Problem Analysis
Results Summary

- Logical CF usage
  - Service levels were being met
  - But IntelliMagic Vision predictive analytics highlighted excessive CF response times
- Recommended solution for these workloads was implementing “dyndisp=thin”
  - Both sync and async service times improved dramatically
- Significant CP usage dropped
  - Estimated at half of a CP

Conclusion

zHPF and Coupling Facility can both have significant impact on mainframe cost and performance.

IntelliMagic has unique abilities to proactively monitor and assess these environments, and other z/OS resources such as disk and tape.

To learn more call 214-432-7920 or email Brent.Phillips@intellimagic.net

Thank You!

Web www.intellimagic.net