Planning Your Next Mainframe Processor Upgrade

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Session 44850

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Abstract

Many customers only replace their mainframe every 3-5 years, so properly planning for what machine to go to next is not something they have a lot of practice at. Many simply rely on their vendor to make a good suggestion. But the wise customer will consider multiple factors before making a final decision.

In this session Scott Chapman will share the insight he has garnered from years of planning processor upgrades. He'll explain the basics of running zPCR, why you want to do so, and how you can use the output. Preparing for processor speed changes will be discussed. Finally, some thoughts will be provided about understanding the performance changes after the upgrade.

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  - October 3-7, 2022
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  - September 12-16, 2022
- Parallel Sysplex and z/OS Performance Tuning
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  - See also: http://pivotor.com/cursoryReview.html

- We also have a free Pivotor offering available as well
  - 1 System, SMF 70-72 only, 7 Day retention
  - That still encompasses over 100 reports!

EPS presentations this week

What	Who	When	Where
PSP: z/OS Performance Tuning - Some Top Things You May Not Know	Peter Enrico Scott Chapman	Tue 1:15	Delaware A
Planning Your Next Mainframe Processor Upgrade	Scott Chapman	Tue 2:45	Franklin C
z/OS Performance Risk Management: Easy Things To Do To Reduce the Risk of Bad Performance	Scott Chapman	Wed 10:30	Franklin C
Pinpointing Transient Performance Problems with SMF 98 & 99	Peter Enrico	Thu 8:00	Franklin A
WLM's Algorithms - How WLM Works	Peter Enrico	Thu 1:15	Franklin C

Agenda

- Why I want to talk about this
- Finding your options
- Evaluating your options
- Confirming your success

Why should we talk about this?

This is not a "common" process

- Most customers only upgrade every 3-5 years so they don't have a lot of practice at this
  - Larger shops and shops with more than 1 machine may do this more
- These are not small transactions: it's worth spending some effort on them
  - The first offered solution may be the best one, but understand any trade-offs
- Your business partner will helpfully suggest an upgrade path for you
  - But their recommendations may not be entirely optimal for you
  - I'm not saying anybody is specifically and intentionally leading people astray, but…

We've seen multiple customers in unfortunate situations because they didn't fully vet the business partner's recommended configuration

Three Cost Concerns

- Hardware
  - “Easy” and obvious one
- IBM Software
  - Upgrade usually means new software discount tiers, but understand the specific impact
  - If you’re considering switching between “EC” and “BC” class machines that can also impact the costs involved
- ISV Software
  - If you’re adding capacity, this will likely be the most important one to look at
  - I’ve seen plenty of configurations changed because of ISV software costs
  - Get a good estimate of this before agreeing to anything

Understanding the software costs is a critical point in the evaluation!

Three Configuration Concerns

- Processor Configuration
  - More/Slower vs. Fewer/Faster is generally the big question (much more shortly…)
- I/O Configuration
  - Carrying forward I/O channels “just because” may not always be smart
    - Make sure you have a need for the I/O channels that you’re ordering
    - But do order what you will plausibly need during the life of the machine!
- Plan-ahead Details
  - What is your next capacity upgrade step?
  - How many drawers do you really need?

Many reconfigurations can be done non-disruptively, but in some cases some reconfigurations may require an outage, so talk about future plans now!

Finding your options

How much do you need?

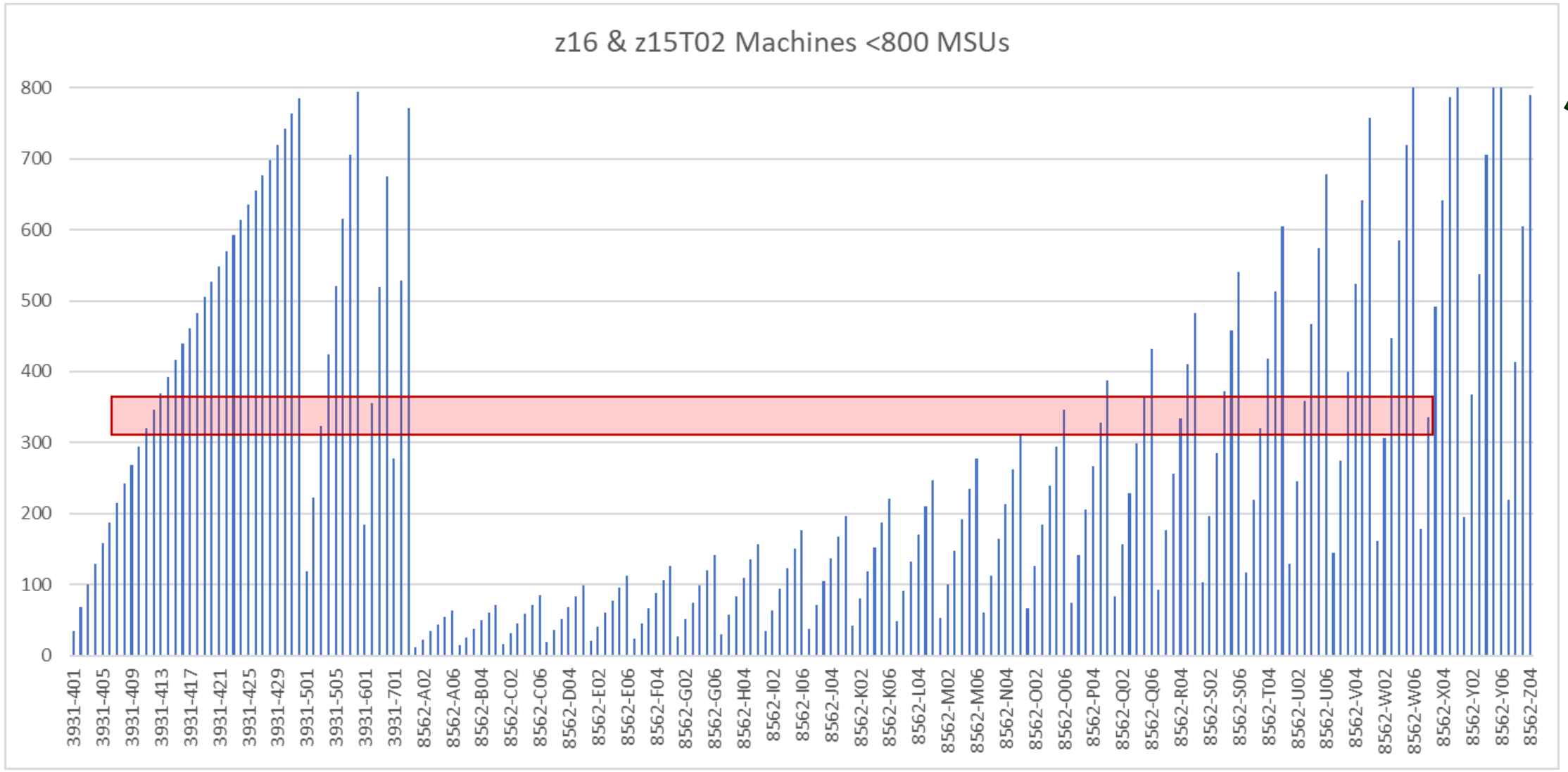
- Over the life of the new machine do you expect your processing requirements to:
  - Increase?
  - Stay about the same?
  - Decrease?
- For example:
  - We expect to process 20% more accounts over the next 3 years
  - We don’t expect any significant changes in processing requirements
  - We’ve been told 50% of the work will leave the mainframe over the next 5 years

What are your financial constraints?

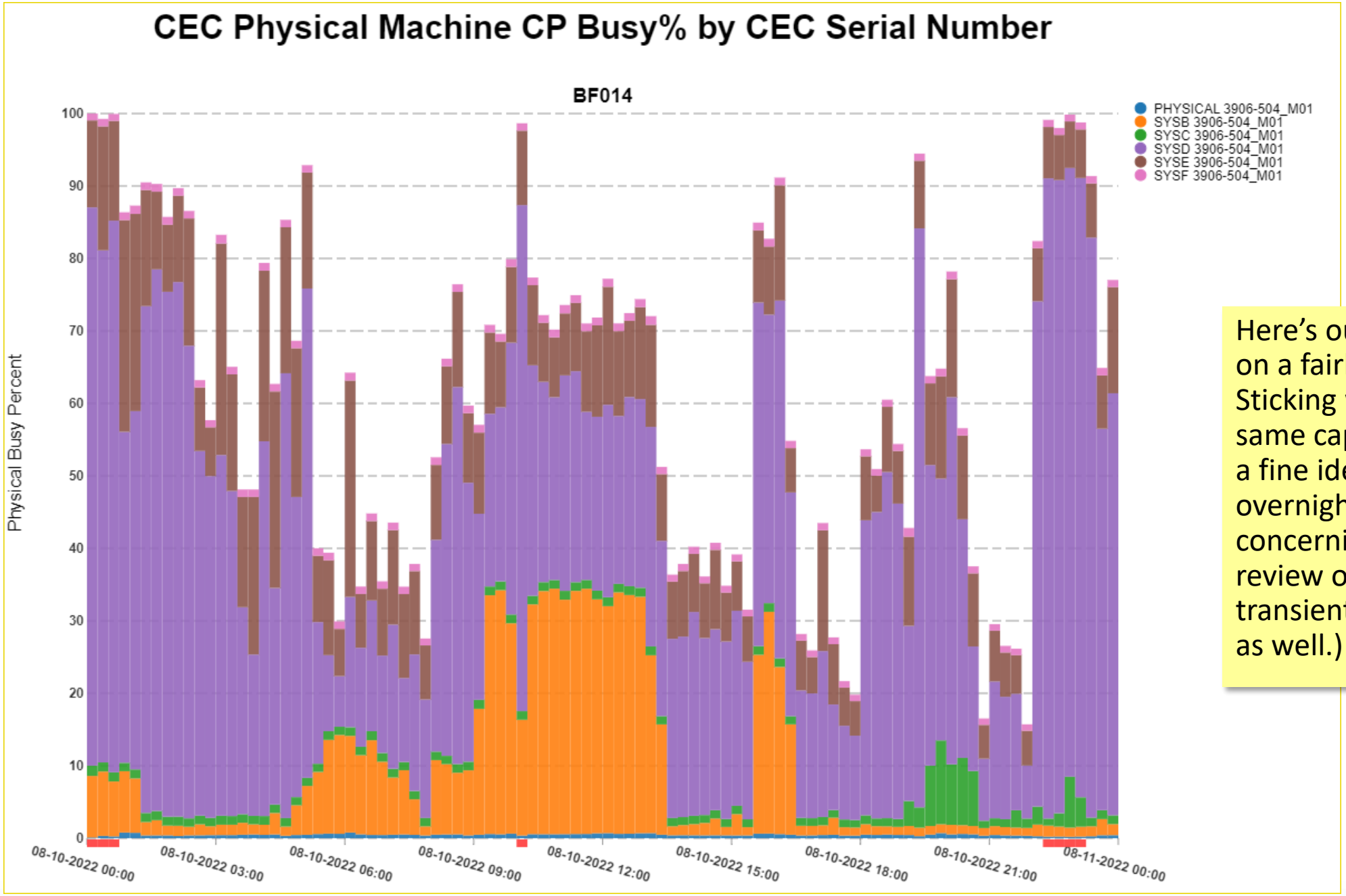
- Do you have software contract limitations which will limit how much capacity you can add?
  - E.G. Software upgrade payments that are more than the hardware cost
- Do you have a requirement to not increase your spend?
- Do you have a need to reduce your overall spend?

Figure out about how much you need

- At this point you're only interested in rough sizing based on your currently installed machine
- So if you need 20% growth and you have a 300 MSUs now: 360 MSUs
  - This is just a high-level rough estimate at this point!
  - Your predictions about the future probably have significant margins of error
- "Stay the same" targets are have more inherent risk
  - If you get it wrong you'll feel it now instead of some time in the future
  - If you do everything perfectly, IBM says there's still a +/-5% margin of error when comparing across machine generations
  - If missing by 5% is going to cause issues, you probably should be thinking about adding capacity!



There can be several potential options. Let's pretend we're coming from a z14-504 and want to stay close to that 337 MSUs on z16 or z15T02 machine.



Here's our example z14 on a fairly typical day. Sticking with about the same capacity seems like a fine idea if those overnight peaks are not concerning. (But also review other days and transient performance as well.)

Detailed Options

- The tendency might be to stick with a z16 5xx series machine, but a z16 504 is significantly over at 424 MSUs and a z16 503 is a bit under at 324.
- The z16 412 is a bit more total capacity with 3x as many engines which are slower
  - Would 3x more engines be beneficial?
  - Which workloads might suffer on slower engines?
  - Could a 411 work?
- 8562-O06 is exactly same MSU rating as the 412, with faster engines (but half as many)
- 8562-R04 is nearly spot on at 334 MSUs

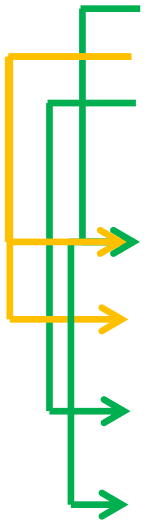
Processor	#CP	PCI**	MSU***
3906-504	**4**	**2731**	**337**
8562-N06	6	2495	310
8562-T03	3	2582	320
3931-411	11	2596	321
3931-503	3	2628	324
8562-P05	5	2649	328
8562-R04	4	2698	334
8562-X02	2	2711	336
3931-412	12	2798	346
8562-O06	6	2794	346
3931-602	2	2873	355
8562-U03	3	2887	358
8562-Q05	5	2959	367
8562-Y02	2	2977	368
3931-413	13	2996	370
8562-S04	4	3016	373
8562-P06	6	3123	387
3931-414	14	3189	393
8562-V03	3	3227	400
8562-R05	5	3310	410
8562-Z02	2	3340	413
3931-415	15	3377	416
8562-T04	4	3374	418
3931-504	4	3440	424

Broad Generalities

- More/slower engines generally better for system efficiency
  - This becomes more true with more LPARs and more concurrent work
    - CPU time will go up, but CPU wait time will go down
  - Do have to be careful about important workloads that need a faster CP though
    - E.G. Older CICS applications that are dependent on the QR TCB
- More/slower often results in better effective capacity utilization per MSU
  - E.G. spend less on software to get the same or more relative capacity
- Fewer than 3 engines troubling unless the machine is dominated by 1 LPAR
  - You can run on a 1- or 2-way but you will likely have more sporadic performance
- 8562 *might* have software pricing advantages
  - Do have to be concerned about the limited number of available CPs though

What if you have to add capacity?

- Business changes: what happens if you have to add capacity before your next machine replacement? What's the next step?
- Easy, low-risk in-machine upgrades:
  - Increasing the CPU count
  - Increasing the CPU speed
- Riskier in-machine upgrades:
  - Go to fewer, but faster CPs
  - Go to more, slower CPs
  - These are doable, but you need to evaluate more closely (like we're about to do for the purchase itself)



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8562-Z02	2	3340	413
3931-415	15	3377	416
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3931-504	4	3440	424

Don’t forget about CPU count limits

- z15-T02 can only have 6 GPs
- z15-T01 can have up to 34 sub-capacity GPs
- Z16-A01 can have up to 39 sub-capacity GPs
- But specific limits in your configuration may be lower due to
  - Other characterized processors (zIIPs, ICFs, IFLs)
  - Specific “MaxN” machine ordered

Evaluating your options

So how do we evaluate those 4 options?

- MSU/MIPS ratings are only gross generalizations of capacity
  - Based on specific tested configurations with specific test workloads
  - Your configuration and workload are different!
- zPCR is your tool to analyze the relative capacity difference in the machines based on your specific LPAR configuration
  - Free download from IBM
  - Relatively easy to use
  - Let's you explore the relative capacity impacts of various changes

https://www.ibm.com/support/pages/getting-started-zpcr-ibms-processor-capacity-reference

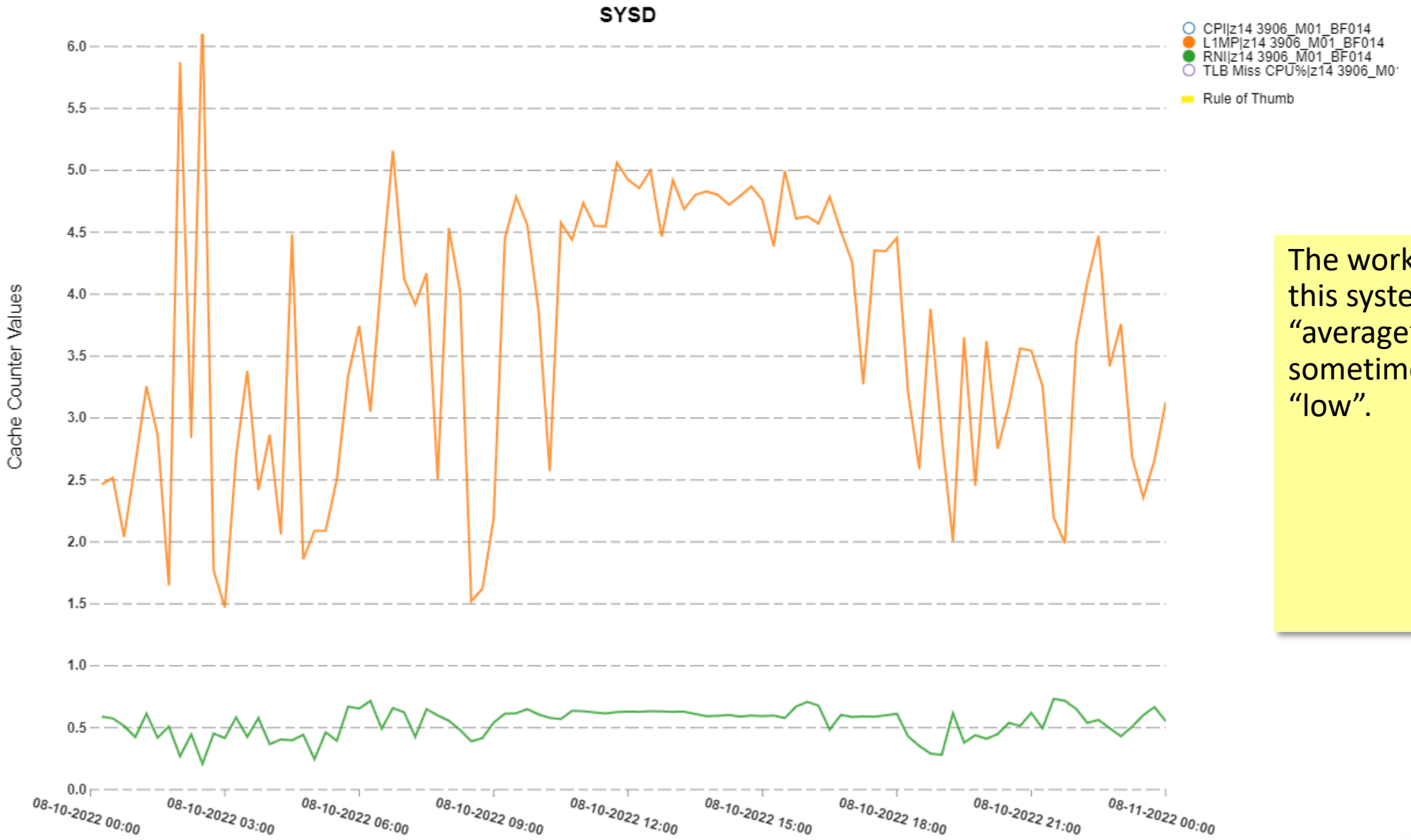
Importance of SMF 113 Data

- For the most accurate planning purposes, zPCR needs to understand how the LPARs are utilizing the processor "nest"
  - Basically: how effective are the processor caches for the workload
- This data is recorded by HIS in the SMF 113 data
- If you have not already done so, enable HIS and the SMF 113 data!
  - Note that you don't normally need HIS profiler (aka sampling) output
  - https://www.ibm.com/docs/en/zos/2.5.0?topic=operations-setting-up-hardware-event-data-collection
- Workload intensity is set from combination of:
  - L1MP – Level 1 Misses Per 100 instructions
  - RNI – Relative Nest Intensity
  - Examine these values from key time periods

L1MP	RNI	Workload Hint
<3	>= 0.75 < 0.75	AVERAGE LOW
3 to 6	>1.0 0.6 to 1.0 < 0.6	HIGH AVERAGE LOW
>6	>= 0.75 < 0.75	HIGH AVERAGE

Processor Caches - CP CPU Key Measurements

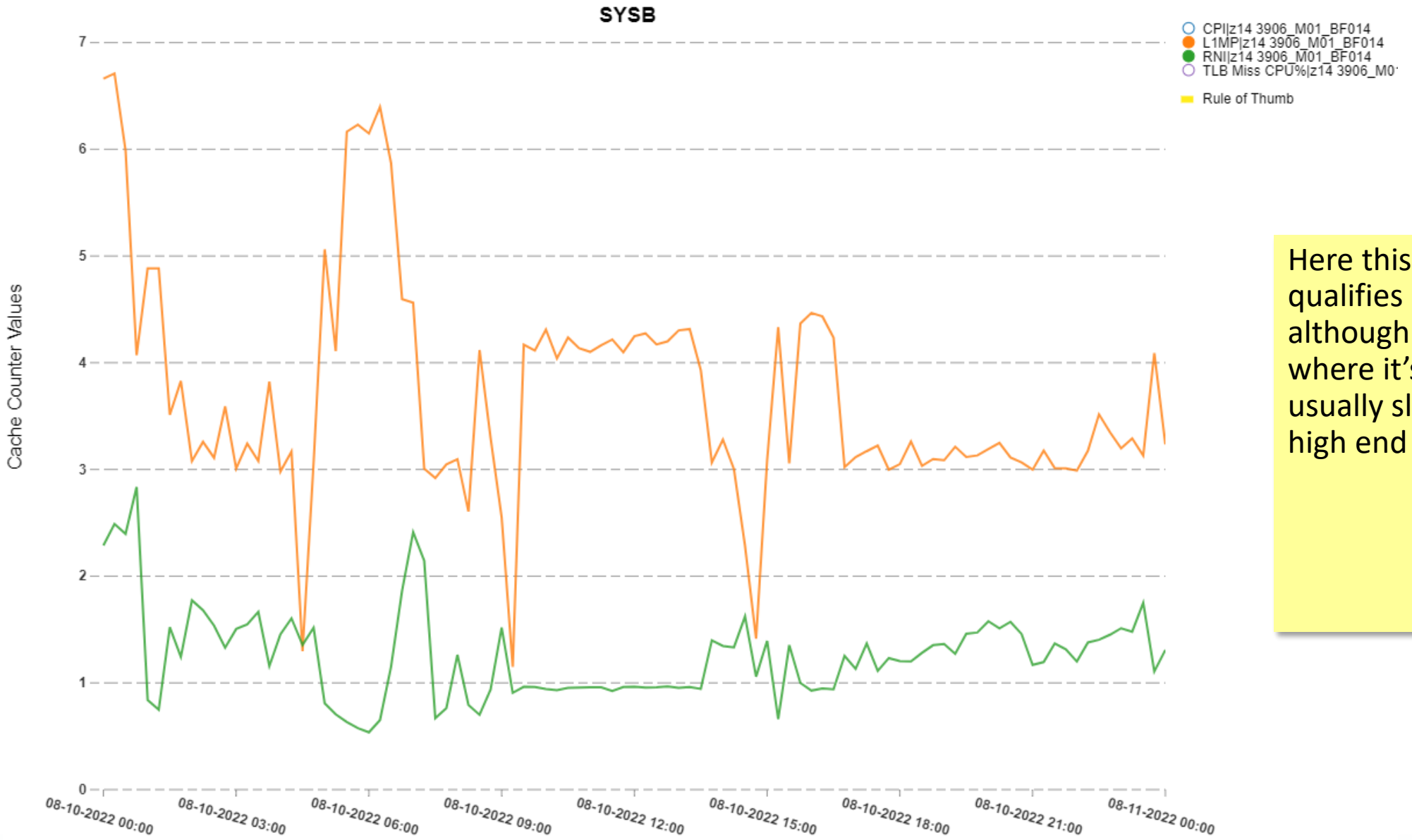
SMF 113



The workload hint for this system is usually “average”, although it sometimes qualifies as “low”.

Processor Caches - CP CPU Key Measurements

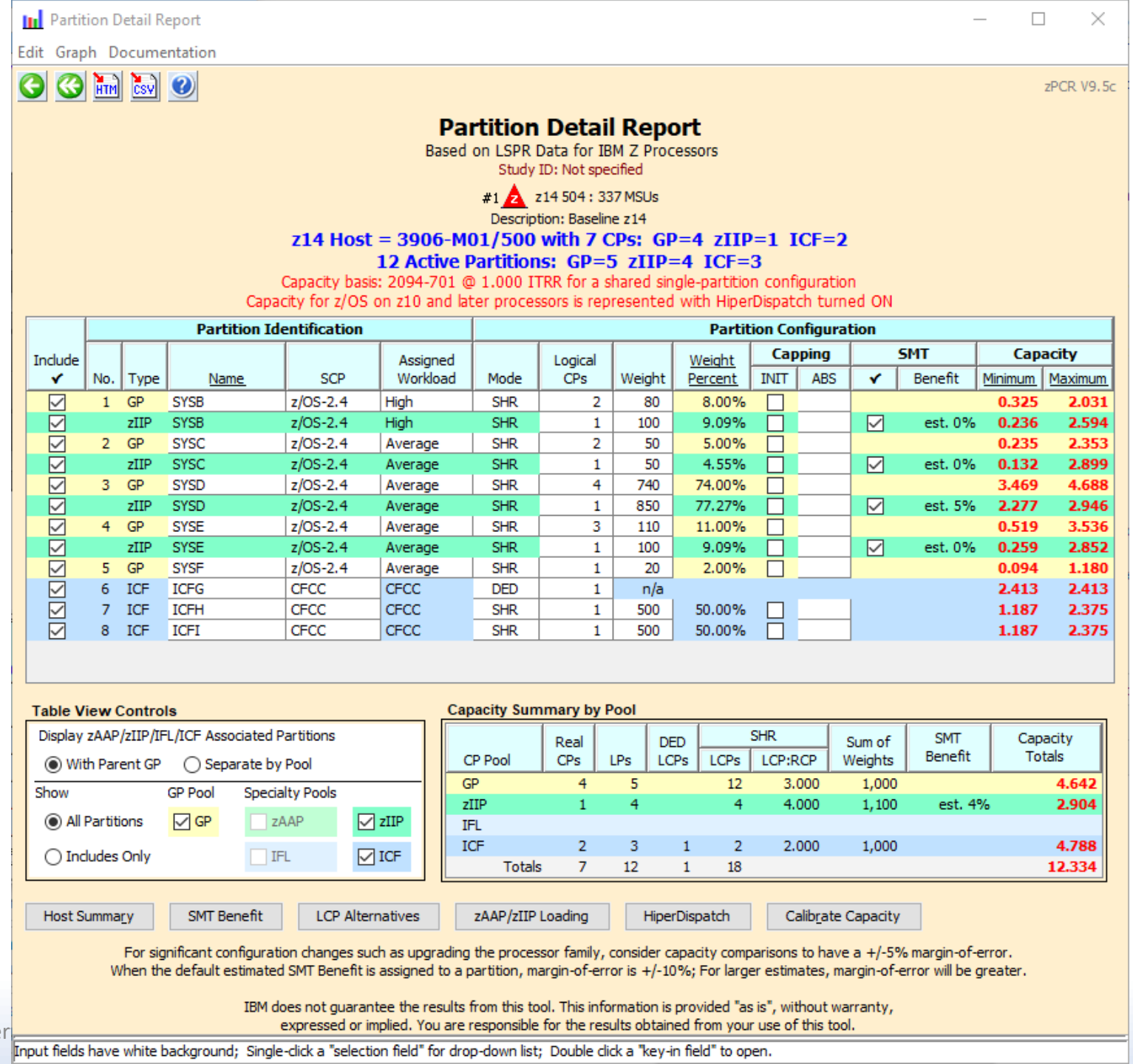
SMF 113



Here this system usually qualifies as “high”, although during periods where it’s busiest it usually slips back to the high end of average.

Configure your baseline in zPCR

- You can import data out of your SMF data by using CP3KEXTR to generate an EDF file, or you can manually define them
  - https://www.ibm.com/support/pages/zos-data-extraction-program-cp3kextr-zpcr-and-zbna
  - EDF input does populate some detailed numbers automatically
  - Choose your interval wisely
- Frankly, doing it manually is pretty quick, but you will need:
  - Number of GPs and zIIPs online to each LPAR
  - LPAR weights for both GPs and zIIPs
  - Workload assignment (previous two slides) for each LPAR
  - Ideally would also be nice to have an estimate of:
    - SMT benefit if using
    - zIIP loading (if they're not as busy as your GPs)



Partition Detail Report

Edit Graph Documentation

zPCR V9.5c

Partition Detail Report

Based on LSPR Data for IBM Z Processors

Study ID: Not specified

#1 z14 504 : 337 MSUs

Description: Baseline z14

z14 Host = 3906-M01/500 with 7 CPs: GP=4 zIIP=1 ICF=2

12 Active Partitions: GP=5 zIIP=4 ICF=3

Capacity basis: 2094-701 @ 1.000 ITRR for a shared single-partition configuration

Capacity for z/OS on z10 and later processors is represented with HiperDispatch turned ON

Include ✔	Partition Identification					Partition Configuration								
										Capping		SMT		Capacity
	No.	Type	Name	SCP	Assigned Workload	Mode	Logical CPs	Weight	Weight Percent	INIT	ABS	✔	Benefit	Minimum	Maximum
☑	1	GP	SYSB	z/OS-2.4	High	SHR	2	80	8.00%	☐				0.325	2.031
☑		zIIP	SYSB	z/OS-2.4	High	SHR	1	100	9.09%	☐		☑	est. 0%	0.236	2.594
☑	2	GP	SYSC	z/OS-2.4	Average	SHR	2	50	5.00%	☐				0.235	2.353
☑		zIIP	SYSC	z/OS-2.4	Average	SHR	1	50	4.55%	☐		☑	est. 0%	0.132	2.899
☑	3	GP	SYSD	z/OS-2.4	Average	SHR	4	740	74.00%	☐				3.469	4.688
☑		zIIP	SYSD	z/OS-2.4	Average	SHR	1	850	77.27%	☐		☑	est. 5%	2.277	2.946
☑	4	GP	SYSE	z/OS-2.4	Average	SHR	3	110	11.00%	☐				0.519	3.536
☑		zIIP	SYSE	z/OS-2.4	Average	SHR	1	100	9.09%	☐		☑	est. 0%	0.259	2.852
☑	5	GP	SYSF	z/OS-2.4	Average	SHR	1	20	2.00%	☐				0.094	1.180
☑	6	ICF	ICFG	CFCC	CFCC	DED	1	n/a						2.413	2.413
☑	7	ICF	ICFH	CFCC	CFCC	SHR	1	500	50.00%	☐				1.187	2.375
☑	8	ICF	ICFI	CFCC	CFCC	SHR	1	500	50.00%	☐				1.187	2.375

Table View Controls

Display zAAP/zIIP/IFL/ICF Associated Partitions

◉ With Parent GP ○ Separate by Pool

Show	GP Pool	Specialty Pools	
◉ All Partitions	☑ GP	☐ zAAP	☑ zIIP
○ Includes Only		☐ IFL	☑ ICF

Capacity Summary by Pool

CP Pool	Real CPs	LPs	DED LCPs	SHR LCPs	SHR LCP:RCP	Sum of Weights	SMT Benefit	Capacity Totals
GP	4	5		12	3.000	1,000		4.642
zIIP	1	4		4	4.000	1,100	est. 4%	2.904
IFL								
ICF	2	3	1	2	2.000	1,000		4.788
Totals	7	12	1	18				12.334

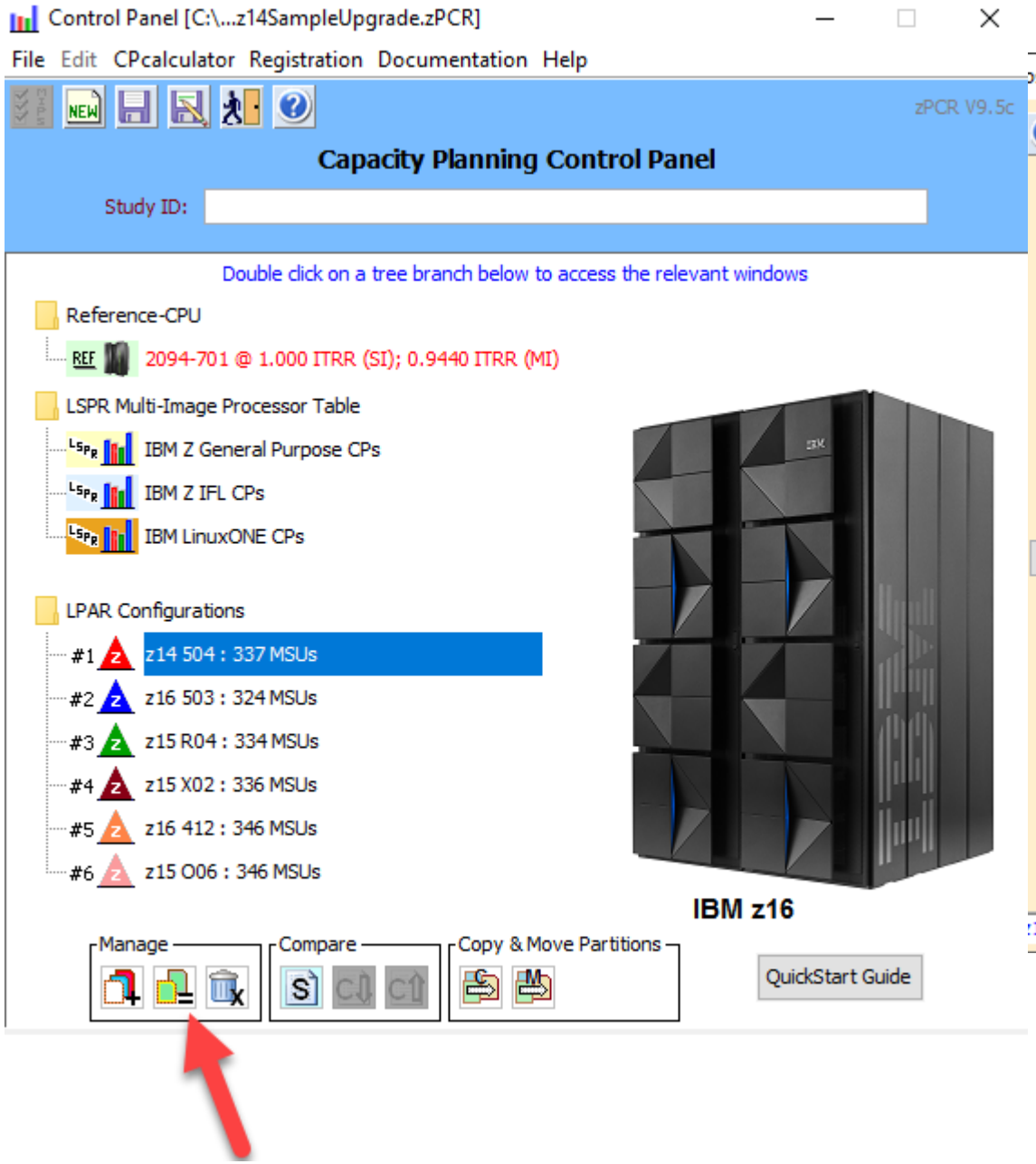
Host Summary | SMT Benefit | LCP Alternatives | zAAP/zIIP Loading | HiperDispatch | Calibrate Capacity

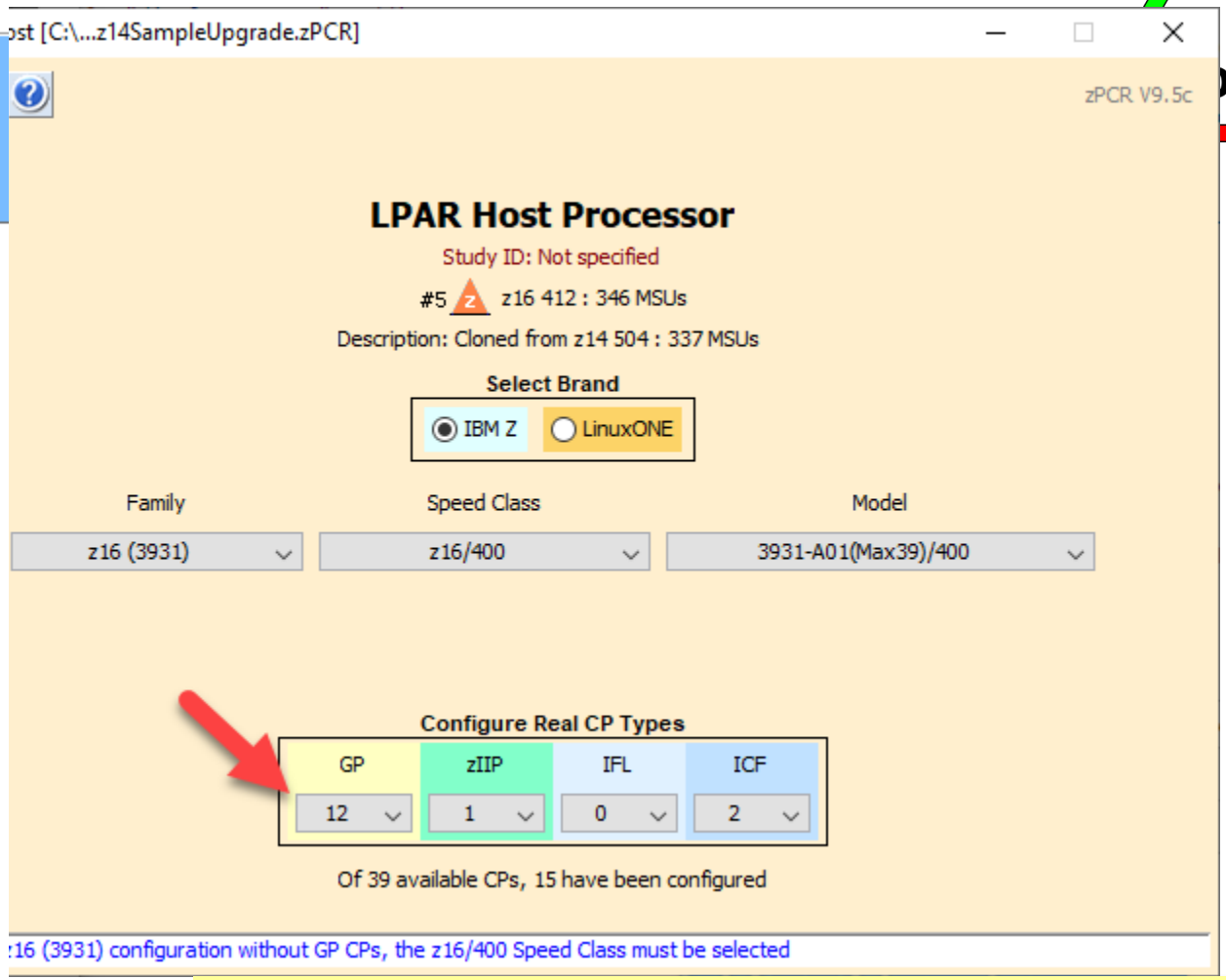
For significant configuration changes such as upgrading the processor family, consider capacity comparisons to have a +/-5% margin-of-error.
When the default estimated SMT Benefit is assigned to a partition, margin-of-error is +/-10%; For larger estimates, margin-of-error will be greater.

IBM does not guarantee the results from this tool. This information is provided "as is", without warranty, expressed or implied. You are responsible for the results obtained from your use of this tool.

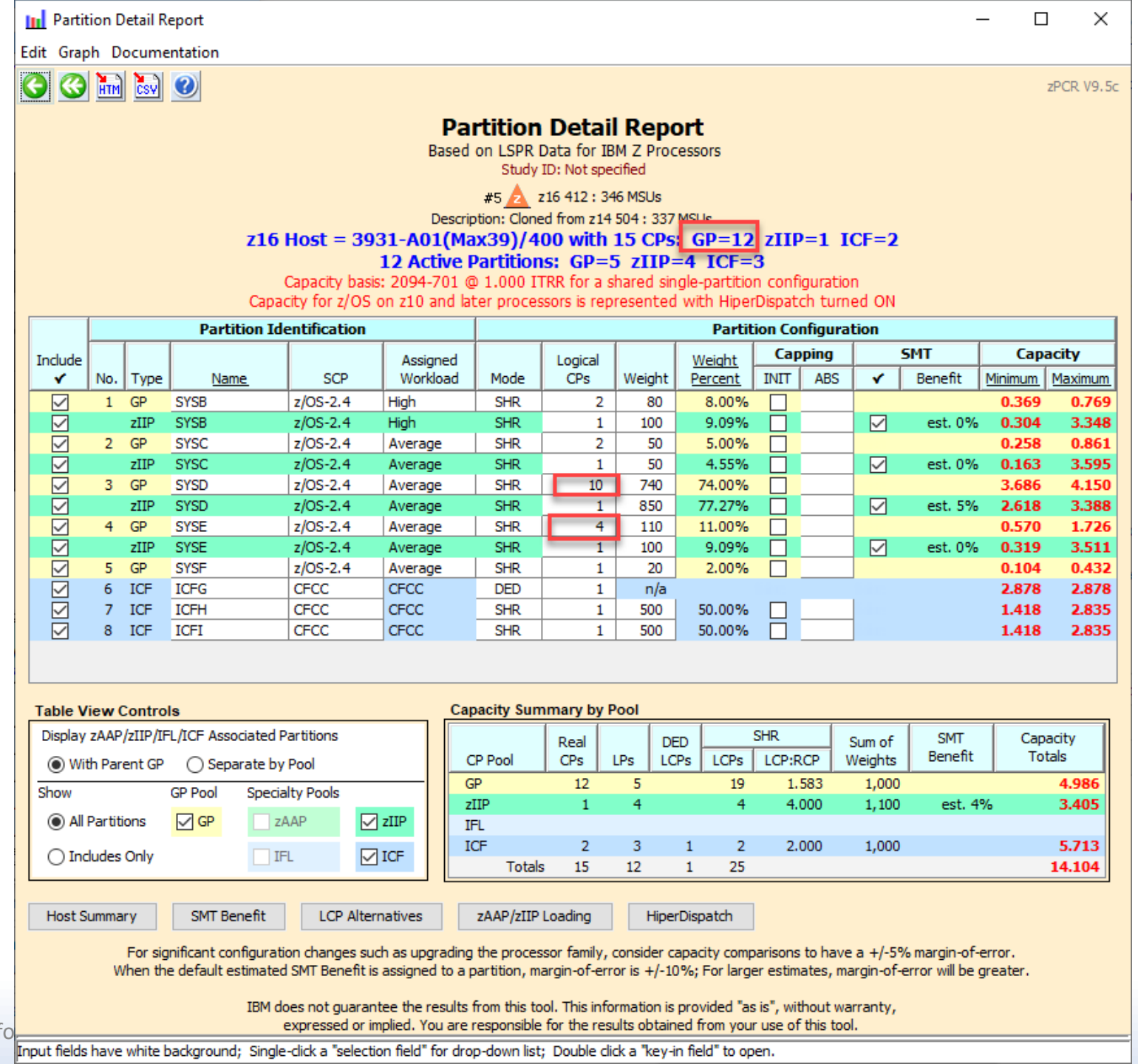
Input fields have white background; Single-click a "selection field" for drop-down list; Double click a "key-in field" to open.

In the end should have your LPARs defined for your “from” machine.





After the first machine, you can use the copy button to clone the configuration and just change the host machine to whatever target you want. Remember to adjust the number of processors online to the LPARs if the new machine has a different number of processors.



Partition Detail Report

Edit Graph Documentation

zPCR V9.5c

Partition Detail Report

Based on LSPR Data for IBM Z Processors

Study ID: Not specified

#5 z16 412 : 346 MSUs

Description: Cloned from z14 504 : 337 MSUs

z16 Host = 3931-A01(Max39)/400 with 15 CPs: GP=12 zIIP=1 ICF=2

12 Active Partitions: GP=5 zIIP=4 ICF=3

Capacity basis: 2094-701 @ 1.000 ITRR for a shared single-partition configuration

Capacity for z/OS on z10 and later processors is represented with HiperDispatch turned ON

Include ✔	Partition Identification					Partition Configuration								
									Capping		SMT		Capacity	
	No.	Type	Name	SCP	Assigned Workload	Mode	Logical CPs	Weight	Weight Percent	INIT	ABS	✔	Benefit	Minimum	Maximum
☑	1	GP	SYSB	z/OS-2.4	High	SHR	2	80	8.00%	☐				0.369	0.769
☑		zIIP	SYSB	z/OS-2.4	High	SHR	1	100	9.09%	☐		☑	est. 0%	0.304	3.348
☑	2	GP	SYSC	z/OS-2.4	Average	SHR	2	50	5.00%	☐				0.258	0.861
☑		zIIP	SYSC	z/OS-2.4	Average	SHR	1	50	4.55%	☐		☑	est. 0%	0.163	3.595
☑	3	GP	SYSD	z/OS-2.4	Average	SHR	10	740	74.00%	☐				3.686	4.150
☑		zIIP	SYSD	z/OS-2.4	Average	SHR	1	850	77.27%	☐		☑	est. 5%	2.618	3.388
☑	4	GP	SYSE	z/OS-2.4	Average	SHR	4	110	11.00%	☐				0.570	1.726
☑		zIIP	SYSE	z/OS-2.4	Average	SHR	1	100	9.09%	☐		☑	est. 0%	0.319	3.511
☑	5	GP	SYSF	z/OS-2.4	Average	SHR	1	20	2.00%	☐				0.104	0.432
☑	6	ICF	ICFG	CFCC	CFCC	DED	1	n/a						2.878	2.878
☑	7	ICF	ICFH	CFCC	CFCC	SHR	1	500	50.00%	☐				1.418	2.835
☑	8	ICF	ICFI	CFCC	CFCC	SHR	1	500	50.00%	☐				1.418	2.835

Table View Controls

Display zAAP/zIIP/IFL/ICF Associated Partitions

◉ With Parent GP ○ Separate by Pool

Show	GP Pool	Specialty Pools	
◉ All Partitions	☑ GP	☐ zAAP	☑ zIIP
○ Includes Only		☐ IFL	☑ ICF

Capacity Summary by Pool

CP Pool	Real CPs	LPs	DED LCPs	SHR LCPs	SHR LCP:RCP	Sum of Weights	SMT Benefit	Capacity Totals
GP	12	5		19	1.583	1,000		4.986
zIIP	1	4		4	4.000	1,100	est. 4%	3.405
IFL								
ICF	2	3	1	2	2.000	1,000		5.713
Totals	15	12	1	25				14.104

Host Summary | SMT Benefit | LCP Alternatives | zAAP/zIIP Loading | HiperDispatch

For significant configuration changes such as upgrading the processor family, consider capacity comparisons to have a +/-5% margin-of-error.
When the default estimated SMT Benefit is assigned to a partition, margin-of-error is +/-10%; For larger estimates, margin-of-error will be greater.

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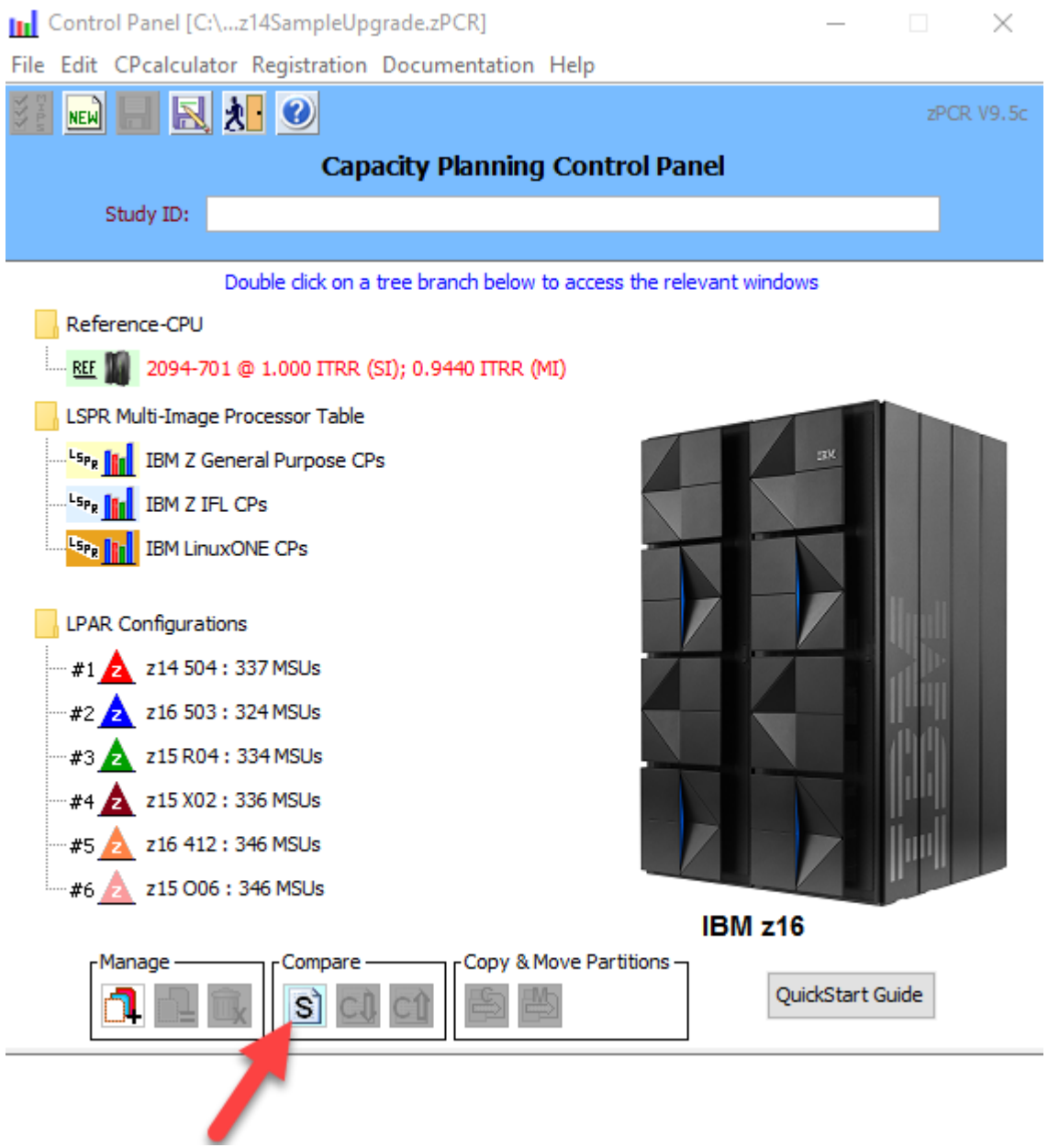
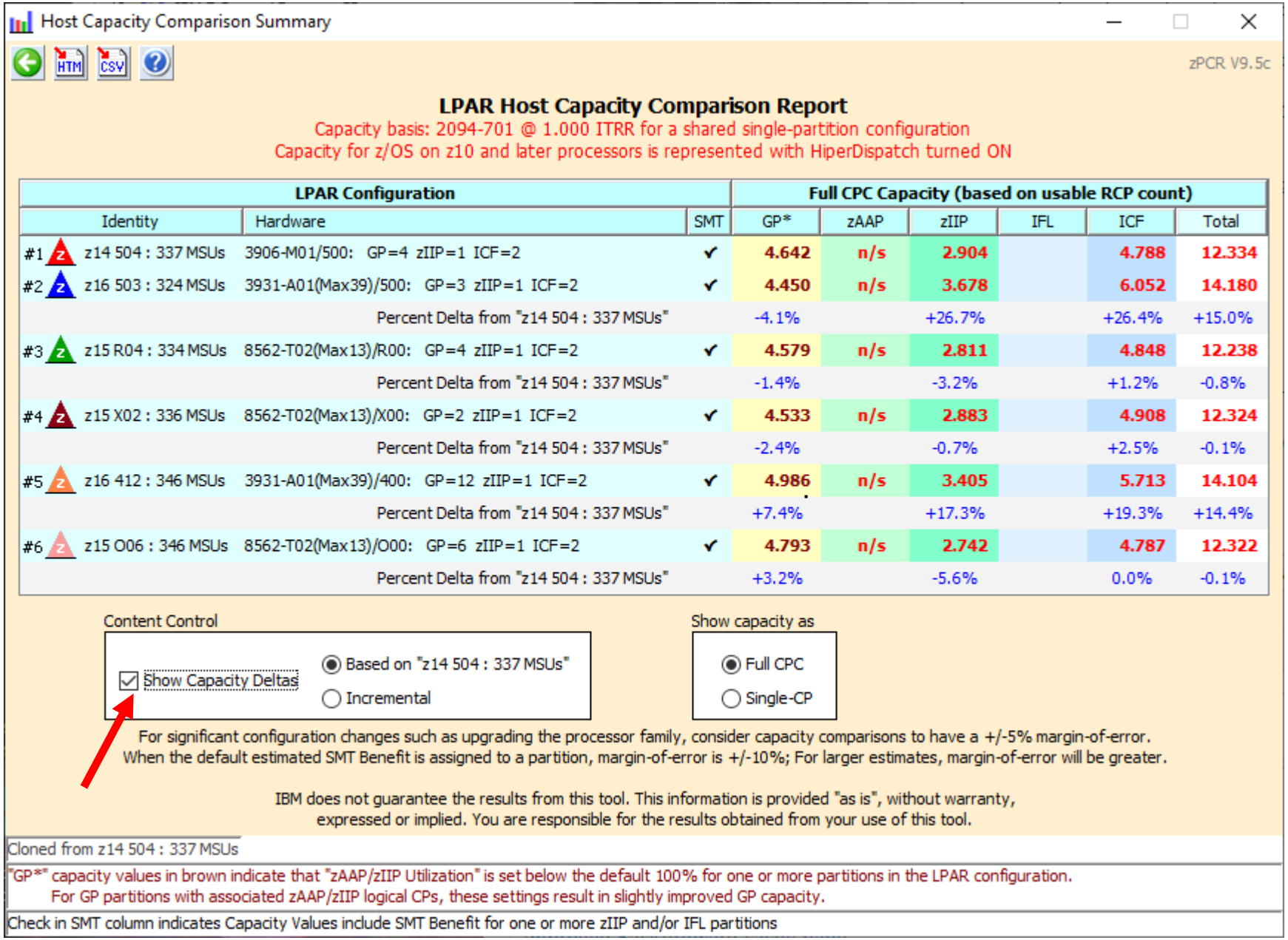
Input fields have white background; Single-click a "selection field" for drop-down list; Double click a "key-in field" to open.

Note the change to the number of logical CPs to the larger LPARs when we increased the number of CPs on the machine.

Have to reduce when you go down in CPs.

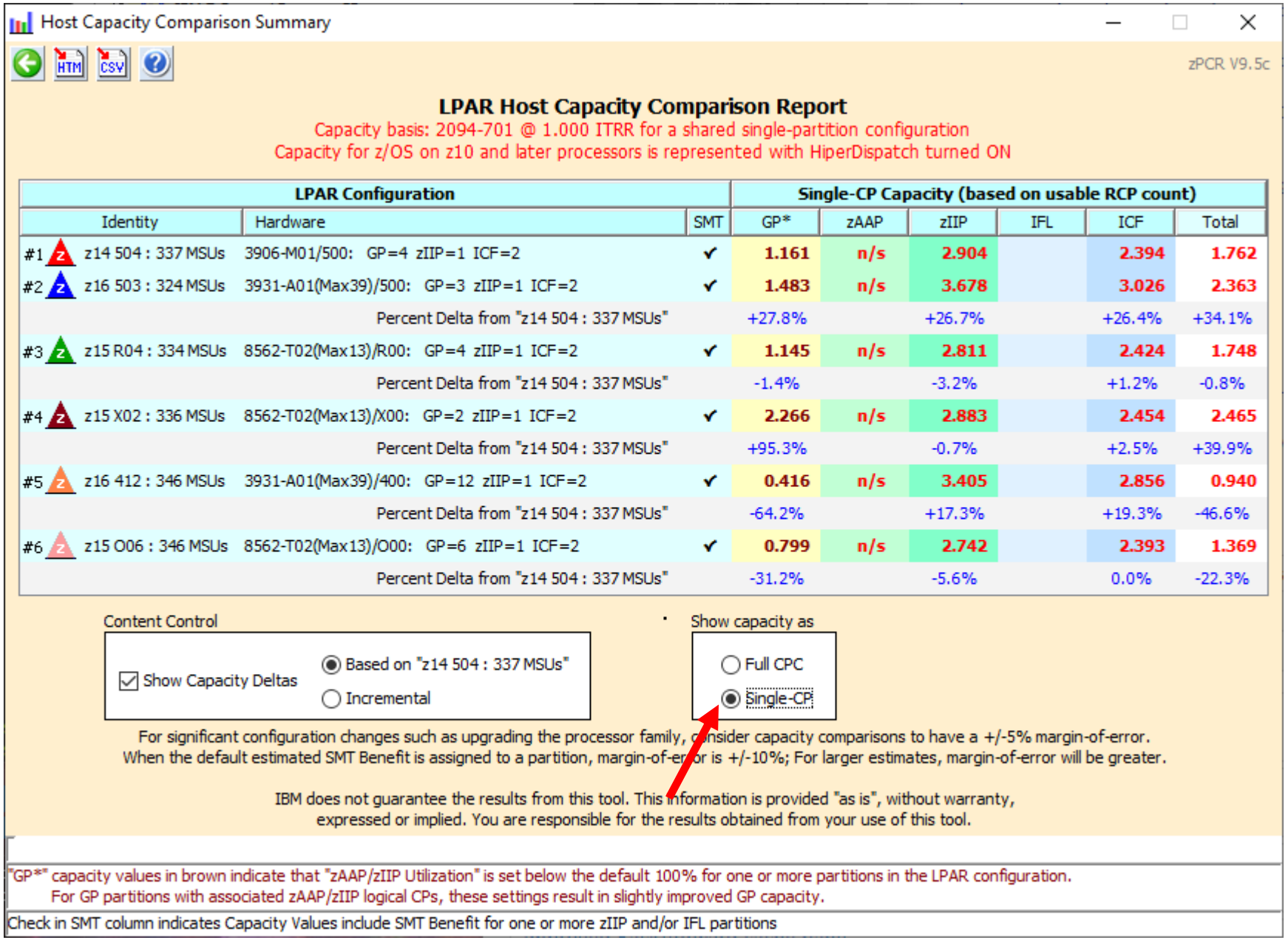


Note that I renamed the configurations to include the machine type and capacity that each scenario represents. This will make it easier to remember what scenario is what when you hit the compare button…



Click “Show Capacity Deltas” to get the important blue numbers which shows the percentage change in overall capacity from our baseline scenario.

Note that the predicted capacity changes are not necessarily aligned with the percent change in MSUs (which drive your software costs).



Host Capacity Comparison Summary

zPCR V9.5c

LPAR Host Capacity Comparison Report

Capacity basis: 2094-701 @ 1.000 ITRR for a shared single-partition configuration
Capacity for z/OS on z10 and later processors is represented with HiperDispatch turned ON

LPAR Configuration				Single-CP Capacity (based on usable RCP count)					
Identity	Hardware	SMT	GP*	zAAP	zIIP	IFL	ICF	Total
#1 z14 504 : 337 MSUs	3906-M01/500: GP=4 zIIP=1 ICF=2	✔	1.161	n/s	2.904		2.394	1.762
#2 z16 503 : 324 MSUs	3931-A01(Max39)/500: GP=3 zIIP=1 ICF=2	✔	1.483	n/s	3.678		3.026	2.363
	Percent Delta from "z14 504 : 337 MSUs"		+27.8%		+26.7%		+26.4%	+34.1%
#3 z15 R04 : 334 MSUs	8562-T02(Max13)/R00: GP=4 zIIP=1 ICF=2	✔	1.145	n/s	2.811		2.424	1.748
	Percent Delta from "z14 504 : 337 MSUs"		-1.4%		-3.2%		+1.2%	-0.8%
#4 z15 X02 : 336 MSUs	8562-T02(Max13)/X00: GP=2 zIIP=1 ICF=2	✔	2.266	n/s	2.883		2.454	2.465
	Percent Delta from "z14 504 : 337 MSUs"		+95.3%		-0.7%		+2.5%	+39.9%
#5 z16 412 : 346 MSUs	3931-A01(Max39)/400: GP=12 zIIP=1 ICF=2	✔	0.416	n/s	3.405		2.856	0.940
	Percent Delta from "z14 504 : 337 MSUs"		-64.2%		+17.3%		+19.3%	-46.6%
#6 z15 O06 : 346 MSUs	8562-T02(Max13)/O00: GP=6 zIIP=1 ICF=2	✔	0.799	n/s	2.742		2.393	1.369
	Percent Delta from "z14 504 : 337 MSUs"		-31.2%		-5.6%		0.0%	-22.3%

Content Control

Show Capacity Deltas

Based on "z14 504 : 337 MSUs"

Incremental

Show capacity as

Full CPC

Single-CP

For significant configuration changes such as upgrading the processor family, consider capacity comparisons to have a +/-5% margin-of-error.
When the default estimated SMT Benefit is assigned to a partition, margin-of-error is +/-10%; For larger estimates, margin-of-error will be greater.

IBM does not guarantee the results from this tool. This information is provided "as is", without warranty, expressed or implied. You are responsible for the results obtained from your use of this tool.

"GP*" capacity values in brown indicate that "zAAP/zIIP Utilization" is set below the default 100% for one or more partitions in the LPAR configuration.
For GP partitions with associated zAAP/zIIP logical CPs, these settings result in slightly improved GP capacity.

Check in SMT column indicates Capacity Values include SMT Benefit for one or more zIIP and/or IFL partitions

Single CP option shows you the impact on the individual CPU speeds. Here we see the potential issue with the 415 option: those engines are only about 1/3rd as fast the current ones.

CPU time will go up by about 3x, but there will be 3x more CPUs to dispatch on.

Comparing options

- I like to summarize the options in Excel
- In this case, the options aren't great
- The z16 412 has the best ratio of effective capacity to MSUs (e.g. software costs) but need to analyze performance data to validate that slower engines will be ok.

		Relative to baseline		
	MSUs	MSUs	Capacity	Speed
z14 504	337	100%	100%	100%
z16 503	324	96%	96%	128%
z15 R04	334	99%	99%	99%
z15 X02	336	100%	98%	195%
z16 412	346	103%	107%	36%
z15 O06	346	103%	103%	69%

- The z16 503 may be ok, the 4% capacity loss may not be significant
  - Some workloads at off hours may appreciate the larger CPs
  - Remember the +/-5% margin of error
- The z15 R04 and z15 O06 may be the least risk options
  - Maybe wait for the 3932-A02 (assuming IBM follows the naming pattern)?

But Scott… What about the z16 602?

- Sometimes you have to appease people…
- But 602 is probably not a good idea
  - +5% MSUs for +3% capacity
  - Plus 2 CPs = larger performance risk

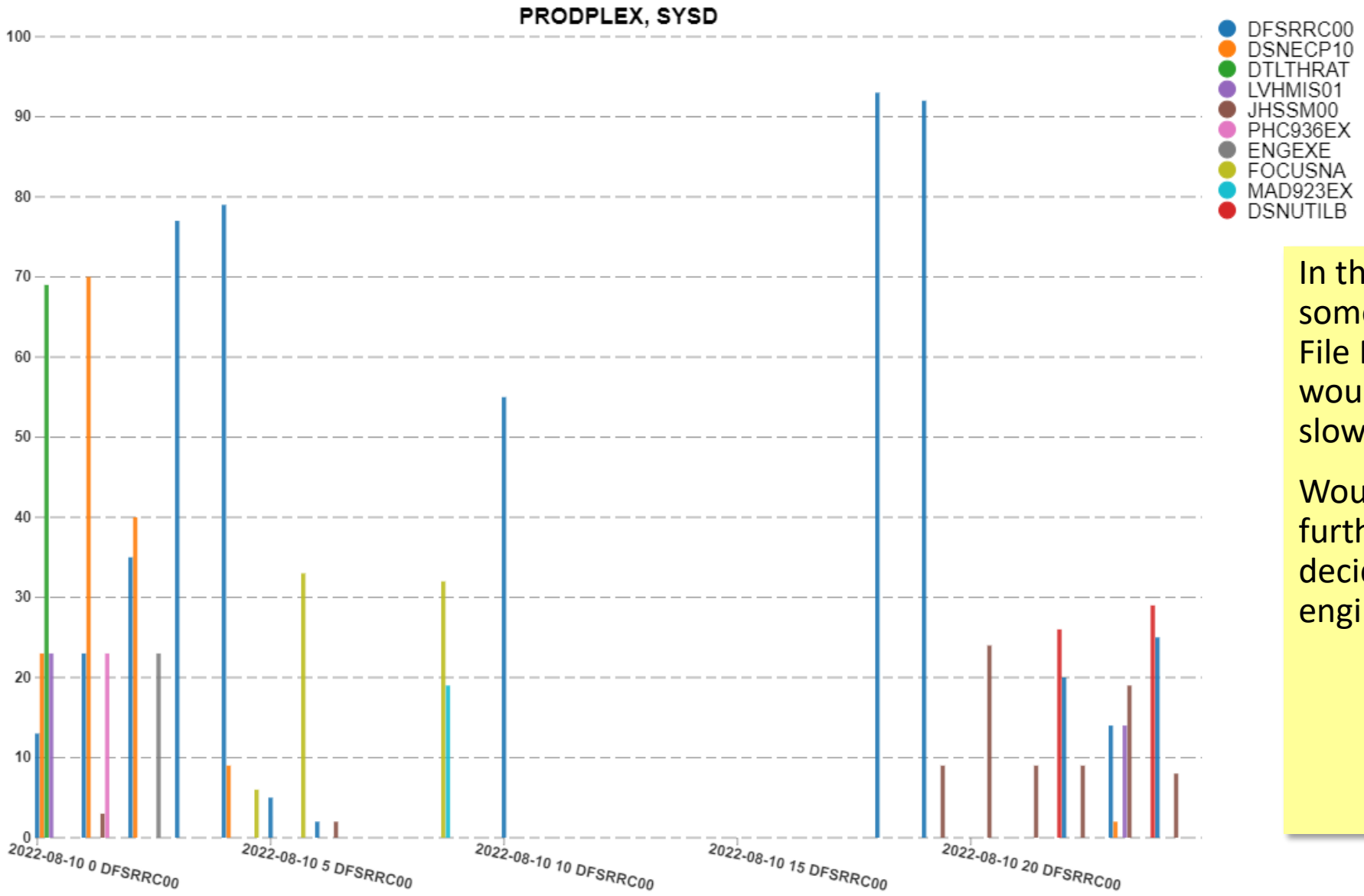
		Relative to baseline		
	MSUs	MSUs	Capacity	Speed
z14 504	337	100%	100%	100%
z16 503	324	96%	96%	128%
z15 R04	334	99%	99%	99%
z15 X02	336	100%	98%	195%
z16 412	346	103%	107%	36%
z15 O06	346	103%	103%	69%
z16 602	355	105%	103%	207%

LPAR Configuration			Full Capacity (based on usable RCP count)					
Identity	Hardware	SMT	GP*	zAAP	zIIP	IFL	ICF	Total
#1 z14 504 : 337 MSUs	3906-M01/500: GP=4 zIIP=1 ICF=2	✔	4.642	n/s	2.904		4.788	12.334
#2 z16 503 : 324 MSUs	3931-A01(Max39)/500: GP=3 zIIP=1 ICF=2	✔	4.450	n/s	3.678		6.052	14.180
	Percent Delta from "z14 504 : 337 MSUs"		-4.1%		+26.7%		+26.4%	+15.0%
#3 z15 R04 : 334 MSUs	8562-T02(Max13)/R00: GP=4 zIIP=1 ICF=2	✔	4.579	n/s	2.811		4.848	12.238
	Percent Delta from "z14 504 : 337 MSUs"		-1.4%		-3.2%		+1.2%	-0.8%
#4 z15 X02 : 336 MSUs	8562-T02(Max13)/X00: GP=2 zIIP=1 ICF=2	✔	4.533	n/s	2.883		4.908	12.324
	Percent Delta from "z14 504 : 337 MSUs"		-2.4%		-0.7%		+2.5%	-0.1%
#5 z16 412 : 346 MSUs	3931-A01(Max39)/400: GP=12 zIIP=1 ICF=2	✔	4.986	n/s	3.405		5.713	14.104
	Percent Delta from "z14 504 : 337 MSUs"		+7.4%		+17.3%		+19.3%	+14.4%
#6 z15 O06 : 346 MSUs	8562-T02(Max13)/O00: GP=6 zIIP=1 ICF=2	✔	4.793	n/s	2.742		4.787	12.322
	Percent Delta from "z14 504 : 337 MSUs"		+3.2%		-5.6%		0.0%	-0.1%
#7 z16 602 : 355 MSUs	3931-A01(Max39)/600: GP=2 zIIP=1 ICF=2	✔	4.799	n/s	3.715		6.089	14.603
	Percent Delta from "z14 504 : 337 MSUs"		+3.4%		+28.0%		+27.2%	+18.4%

What about changing engine speeds?

- Do you have CPU time limits that need to change?
- If going to more/slower engines:
  - CPU time will increase, but CPU wait will likely decrease
  - Do you have single-TCB tasks that will be limited by the CPU speed?
  - CF Sync requests tie up less capacity
  - Performance may be more consistent
- If going to fewer/faster engines:
  - CPU time will decrease, but CPU wait will likely increase
  - Misbehaving tasks & LPARs can dominate more of the total capacity
  - CF Sync requests tie up more capacity
  - Performance may be more variable

Highest Task CPU Percent Programs by Hour



In this case it appears that some workloads (including File Manager for IMS) that would be impacted by slower engines.

Would definitely need further investigation before deciding to go to slower engines.

Confirming your success

Set expectations early

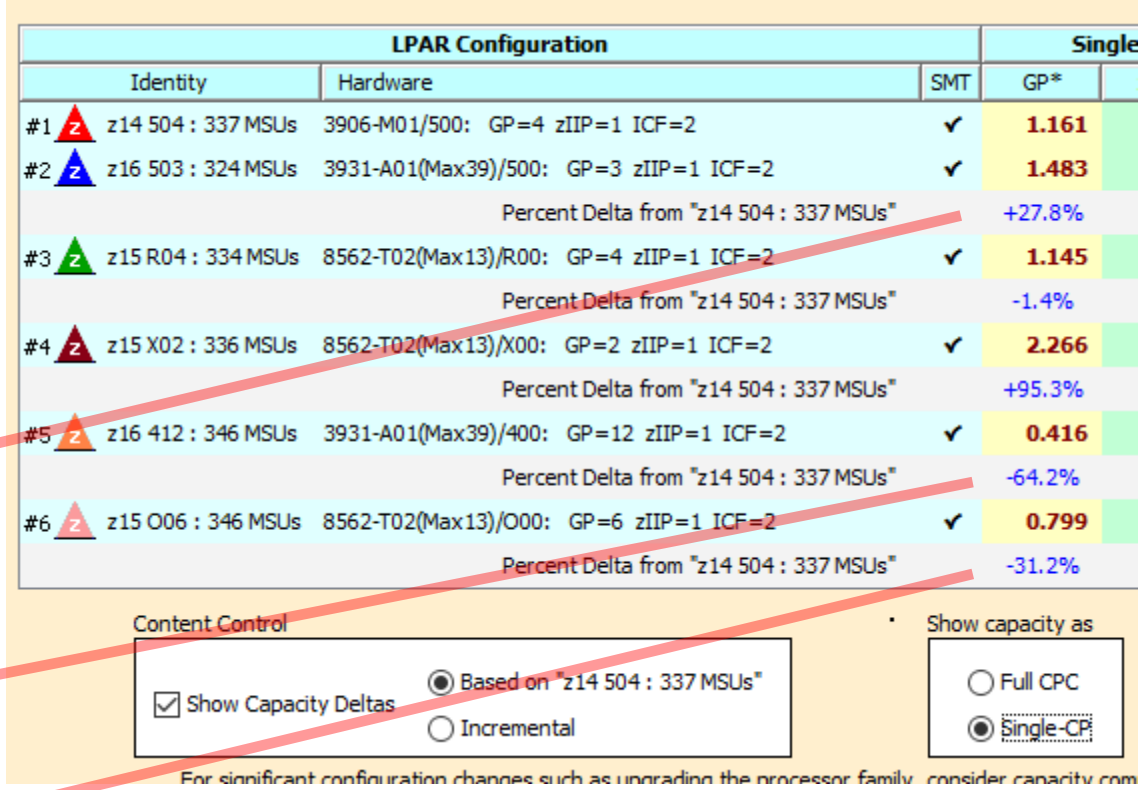
- Why are you upgrading?
  - If it's to solve a problem, measure that "problem" before and after!
- Make sure you have good measurements from your important workloads
  - Understand the normal variability in those measurements
  - You may need multiple days of activity before drawing solid conclusions
- Understand the relative CPU speed change so you can set expectations for new CPU time measurements
  - See next slide
- Understand that some workloads will over- and some under-perform
  - Under-performers are most likely to be older programs that may need a recompile
  - Update your compiler options for the oldest of production and DR machines

CPU Time Conversion

- $cpu_{new} = cpu_{old} / (1 + delta)$

Expected new CPU time	Old CPU time measurement	Single-CP delta from zPCR

- E.G. for a job using 500 CPU seconds on the z14-504
- On z16-503:
  - 500 / (1+.278) = 391 seconds
- On z16-412:
  - 500 / (1-.642) = 1396 seconds
- On z15-O06:
  - 500 / (1-.312) = 727 seconds



+/- 5% of these values is spot-on
Remember to consider the normal variability!

What to evaluate when

- Mostly looking for things whose CPU time is significantly higher than expected, but elapsed time can be important too
  - Elapsed more interesting when upgrading I/O subsystems
  - Faster channels / faster network may help some workloads though
- Can probably start to get some indications first business day for high-volume transactional workloads
- For once-a-day batch, you'll probably need several days to account for the normal variability
- Remember: it's normal for some work to over-perform and some to under-perform! The expectation is that you'll come out ok on average across all workloads.

Wrap-up

In summary…

- Don’t just accept the first offered solution: understand the pros and cons of different options
- Don’t overlook changing to a “mid-range” machine or to slower engines
- Build your own zPCR models: it’s free, not difficult, and forces you to think through things
- Once you’ve selected an option, know what the expected change to the CPU time measurements will be
- Evaluate your most important workloads after the migration to make sure they’re within expectations

Your feedback is important!

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Thanks!
Questions?

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