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Server Virtualization Technical and Total Cost Analysis

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IBM System z Technical Support

Thursday, March 3, 2011: 11:00 AM-12:00 PM
Room 204A (Anaheim Convention Center)



[Topics](#)

Session Abstract

- **Server Virtualization Technical and Total Cost Analysis**

- Thursday, March 3, 2011: 11:00 AM-12:00 PM

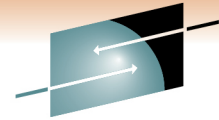
- Room 204A (Anaheim Convention Center)

- Speaker: [Montgomery Bauman](#) (IBM Corporation)

- Server proliferation is a well known issue in today's IT world. Server virtualization offers hope at combating server proliferation. But which virtualization offering (or offerings) is optimal for a given set of discrete servers?

IBM has developed a methodology and companion tool (RACEv) that aspires to help customers analyze servers that are subject to virtualization and in so doing provide a total cost of ownership viewpoint of those servers virtualized onto one of the following virtualization platforms:

- System z, using PR/SM and z/VM
 - x86, using VMware
 - POWER, using PowerVM
 - Sun, using LDOM (or Zones)
- The analysis considers technical constraints on processors, memory, I/O, and hypervisors. Once a constraint-free target configuration is derived, the cost models run generating costing in the following categories:
 - energy
 - floorspace
 - server acquisition and maintenance
 - storage acquisition and maintenance
 - connectivity acquisitions and maintenance
 - software licenses and support
 - administration
 - disaster recovery acquisitions and maintenance
 - disaster recovery annualized costs
 - cost of outages
 - The analysis concludes with a 5 year total cost of ownership chart that even a manager can understand!!!
 - Tracks: Virtualization for New Services and Virtualization of Existing Resources

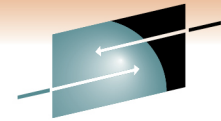


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Topics

1. The RACE Program's Mission
 2. The RACEv Modeling Methodology
 3. RACEv Run-Through
 - RACEv Workflow
 4. Additional RACEv Functions and Features
 5. Conclusion
-
- Appendix

The RACE Program's Mission

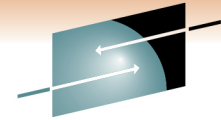


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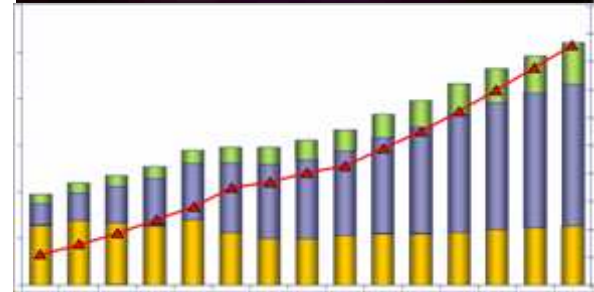
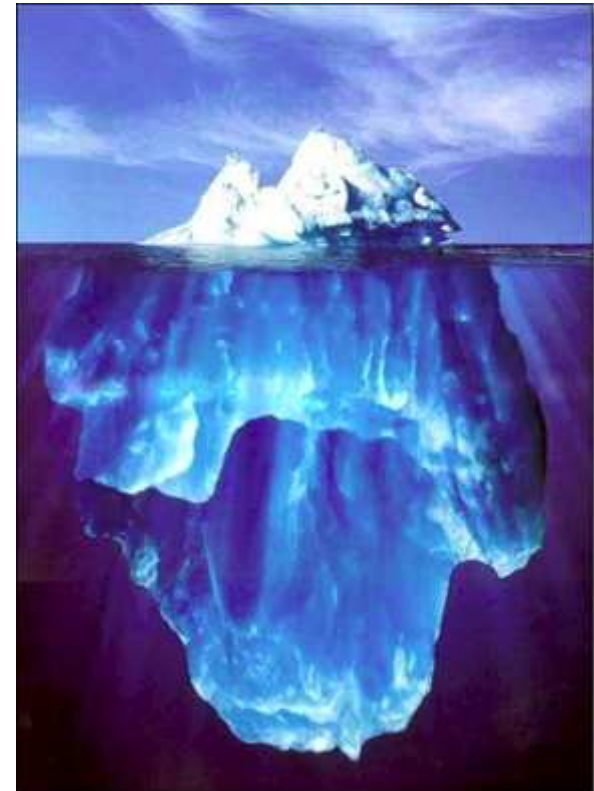
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IT Complexity Drives Many Hidden Costs



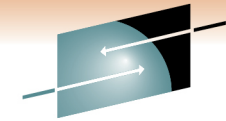
- Managing today's mixed IT platform environments can be complex and costly
 - Proliferation of servers
 - Underutilized assets
 - Proliferation of software licenses
 - Proliferation of distributed control points
 - Ineffective costing methodologies
- **The Result**
 - Massive complexity
 - Spiraling people costs
 - Increased availability and downtime costs
 - Increased security breach costs
 - Sub-optimal investment choices



Source: IDC

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**Virtualization and infrastructure mgt standards
are the only hope to intercept these trends !**



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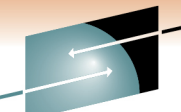
The RACE Mission...

- Choosing the Right Server...
 - For the right reasons...
 - Functional Requirements (1st and foremost)...
 - Where does the software run
 - etc.
 - Non-Functional Requirements...
 - Cost and Value
 - Resilience
 - Skills
 - etc.
- By any other name ...
 - IT Optimization
 - Business Justification
 - Total Cost of Ownership / Total Cost of Computing
 - **“Fit for Purpose”**

RACE
Right-fitting
Applications into
Consolidated
Environments

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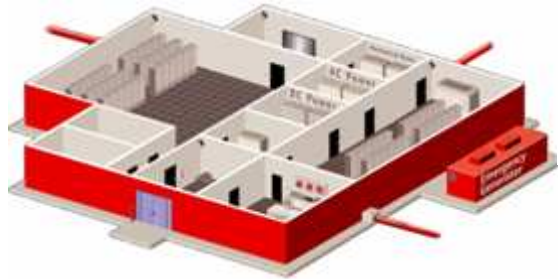
Server Choices and Cost/Value Optimization Points



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Facilities

- Floorspace
- Power
- Cooling



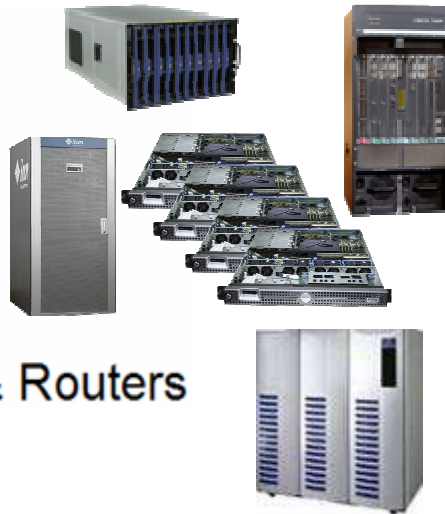
Software

- Licenses
- Support & Subscription



Hardware

- Servers
- Storage
- Networks
- Switches & Routers

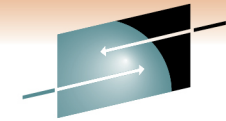


Administration

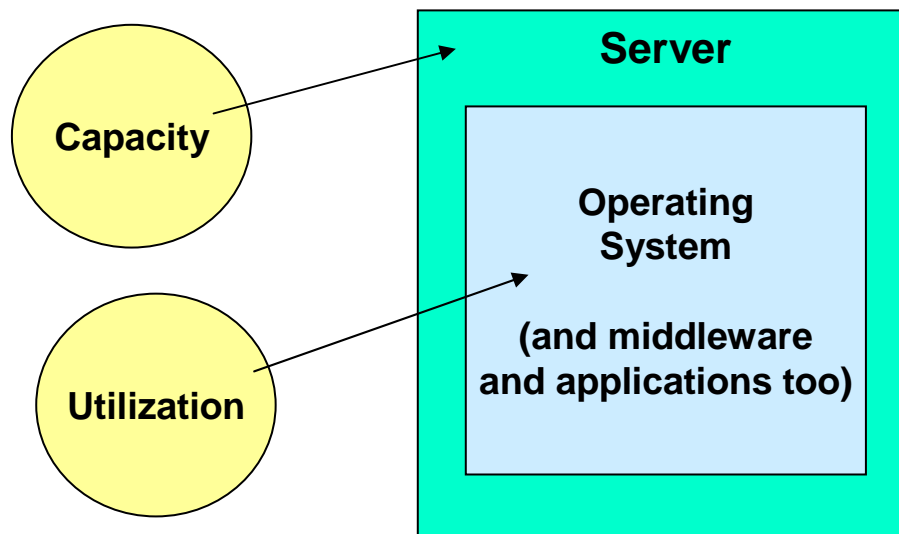
- Data Centers
- Servers
- Software
- Applications
- Data



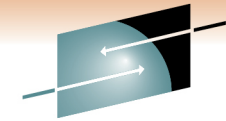
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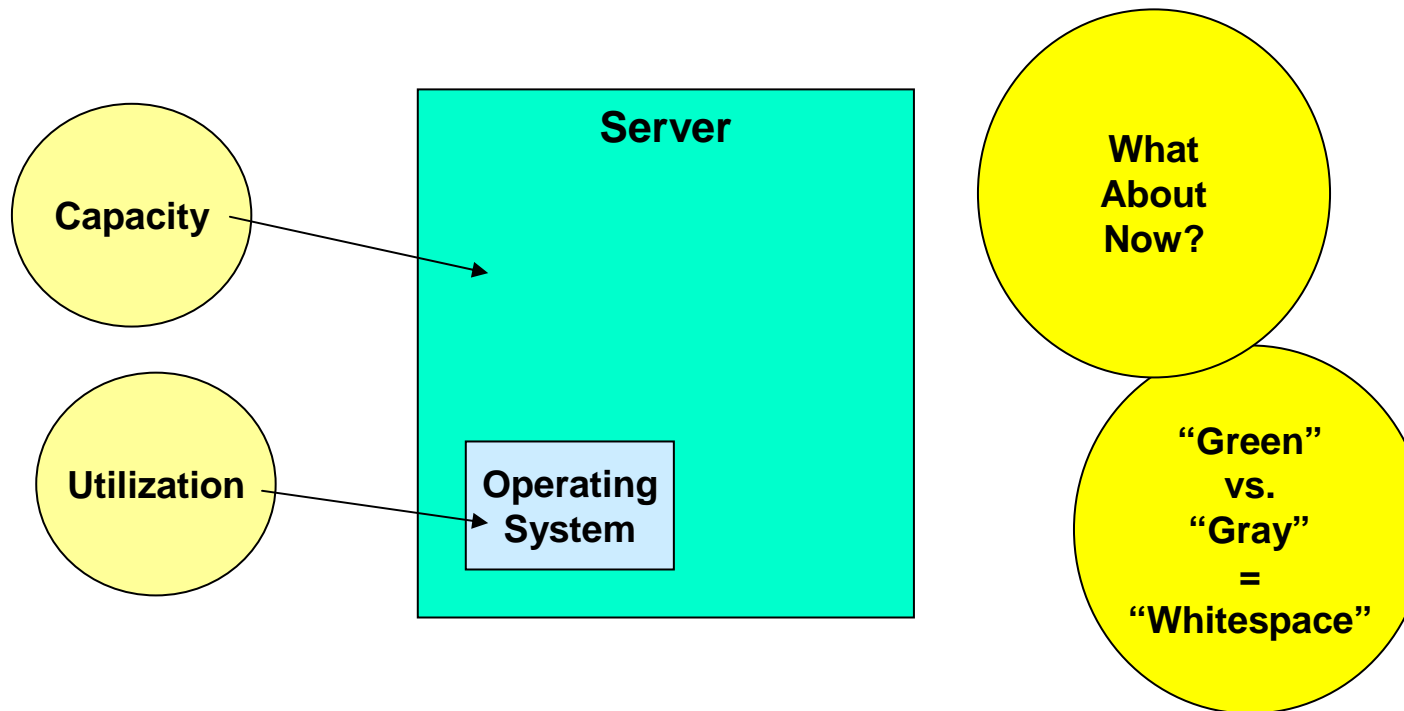
Server Virtualization in a Nutshell (part 1)

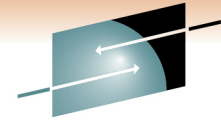


**Not
Much
Wrong
With This
Picture...**



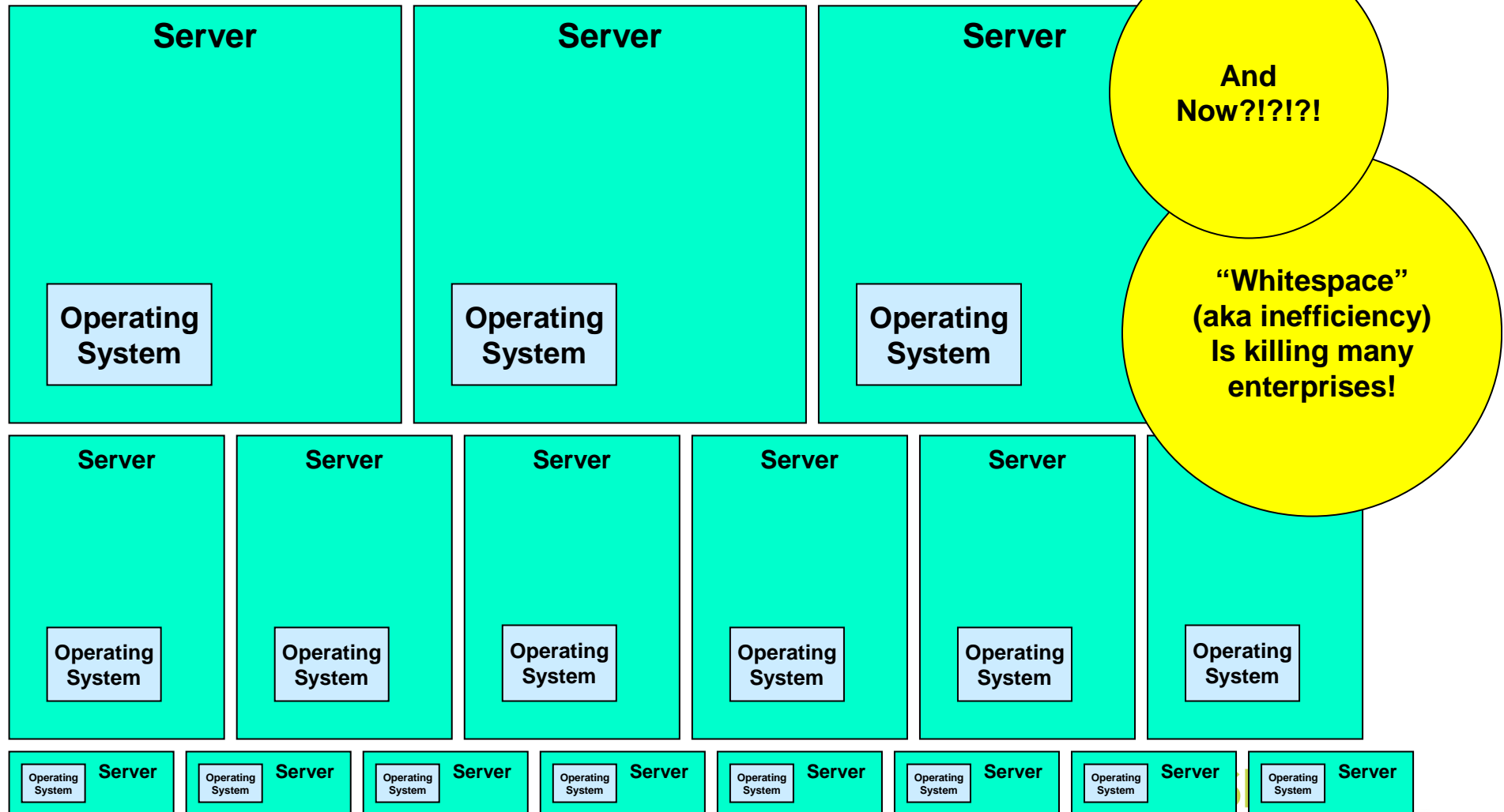
Server Virtualization in a Nutshell (part 2)



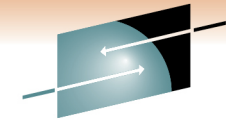


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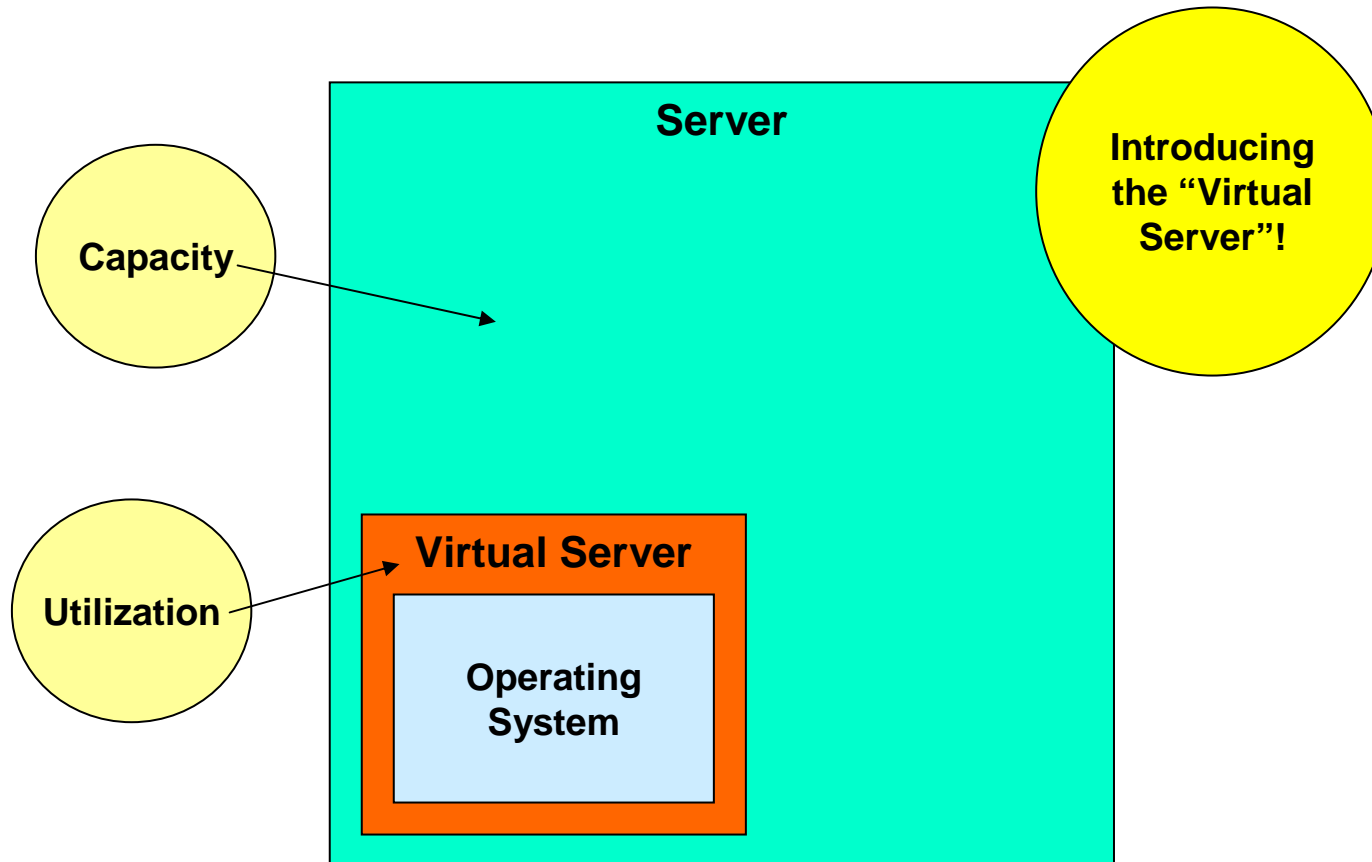
Server Virtualization in a Nutshell (part 3)

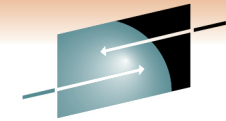


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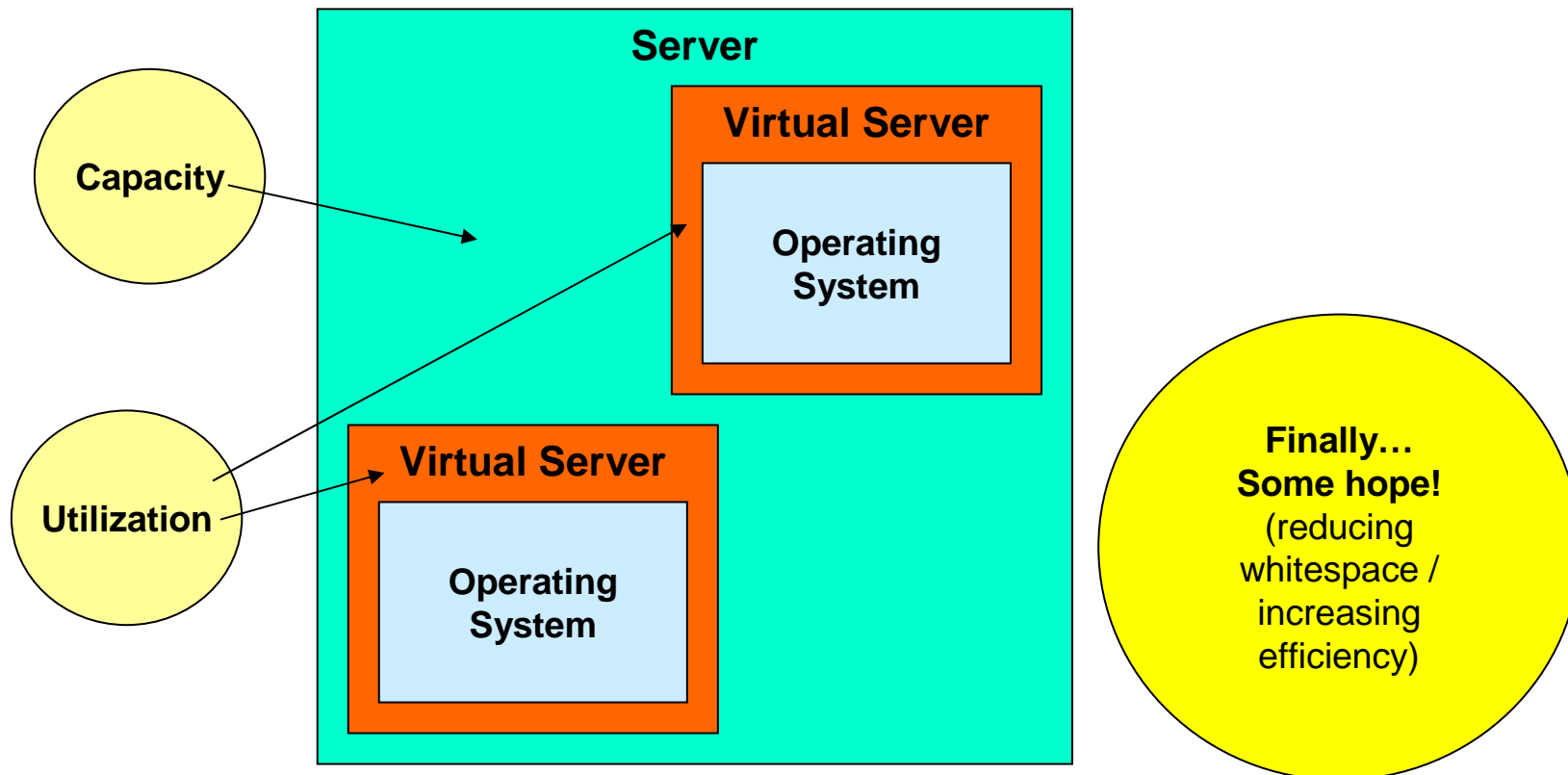


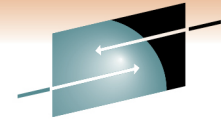
Server Virtualization in a Nutshell (part 4)





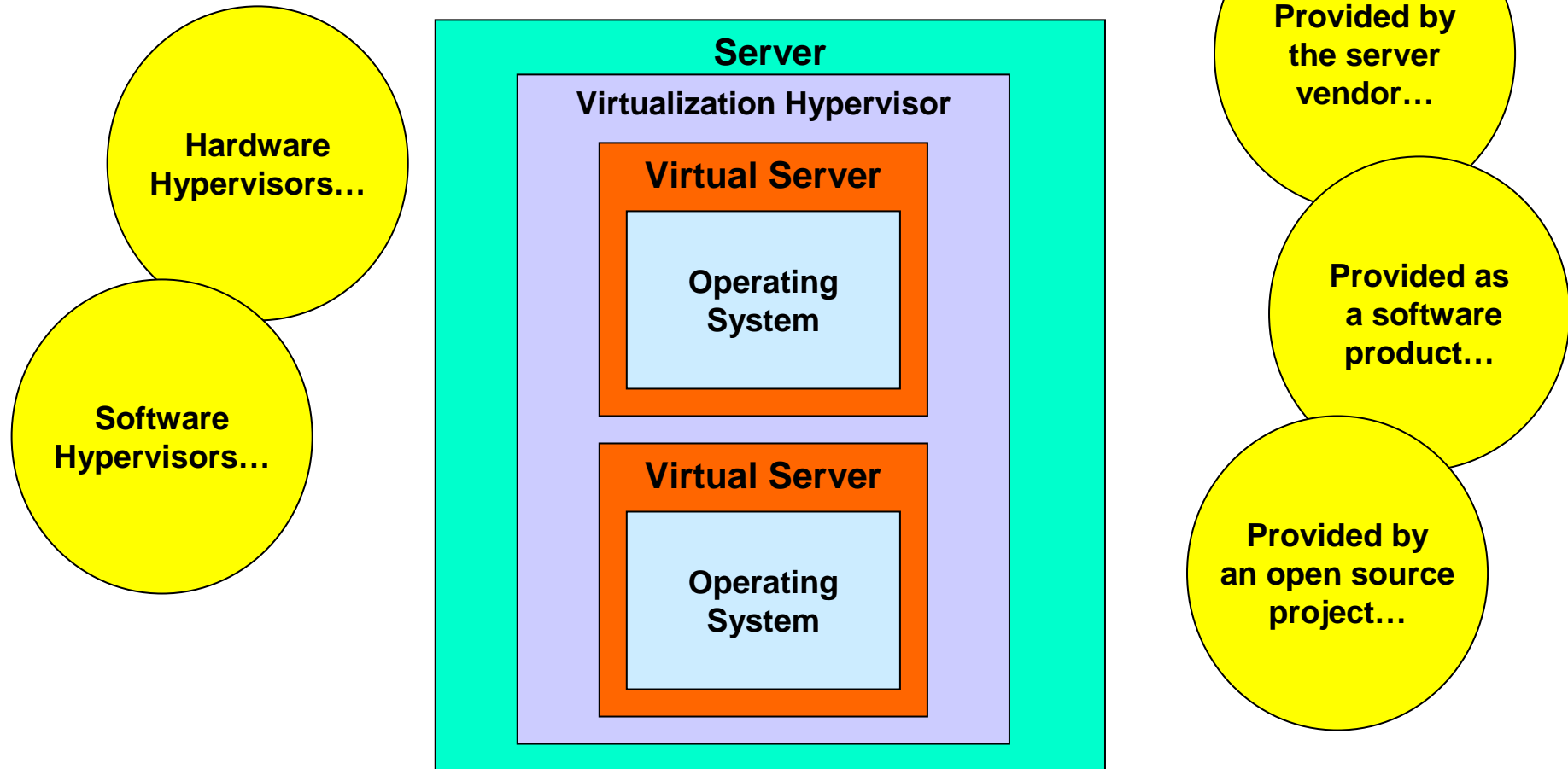
Server Virtualization in a Nutshell (part 5)



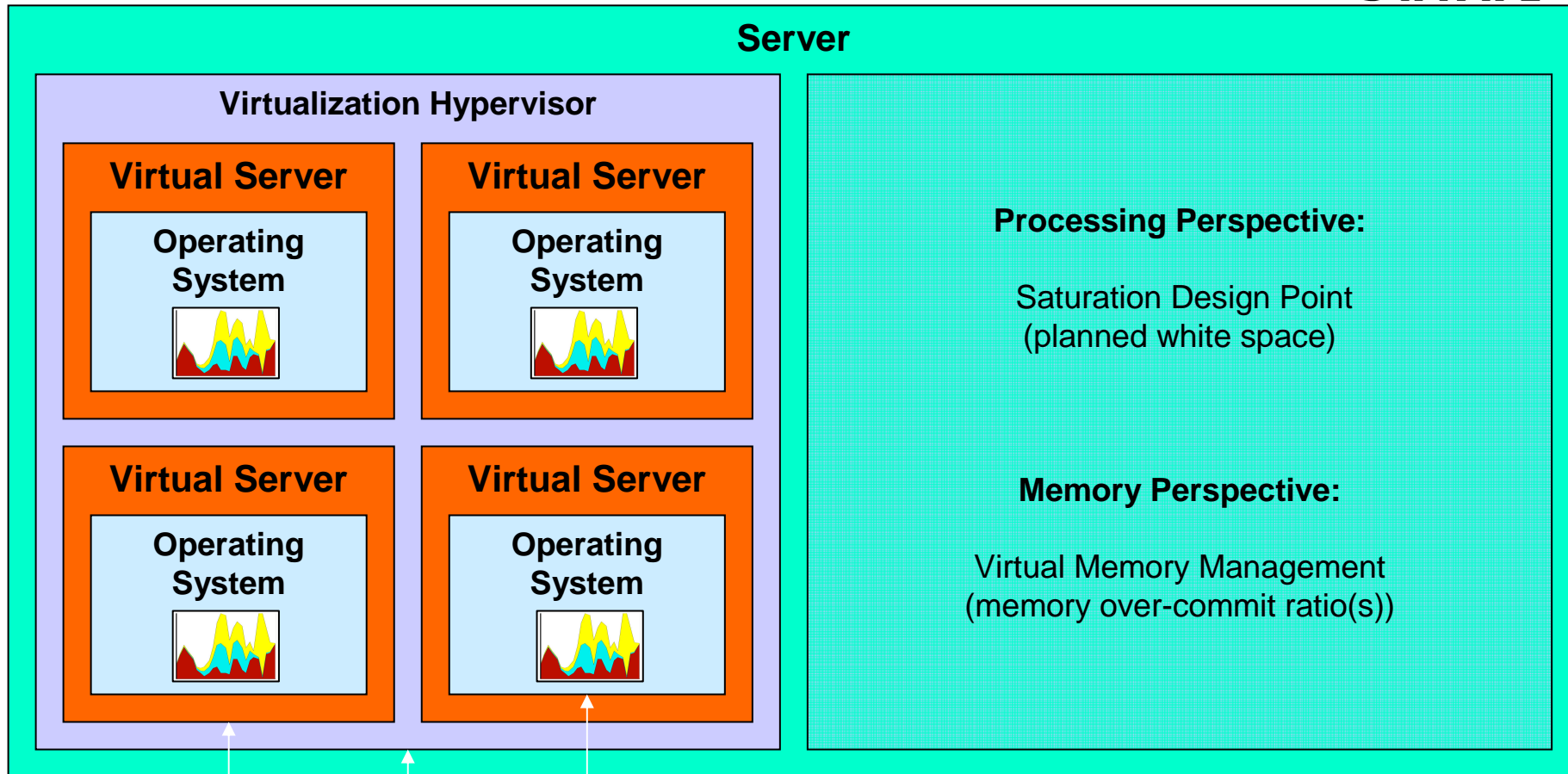


Server Virtualization in a Nutshell (part 6)

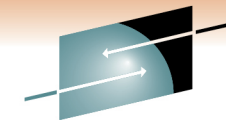
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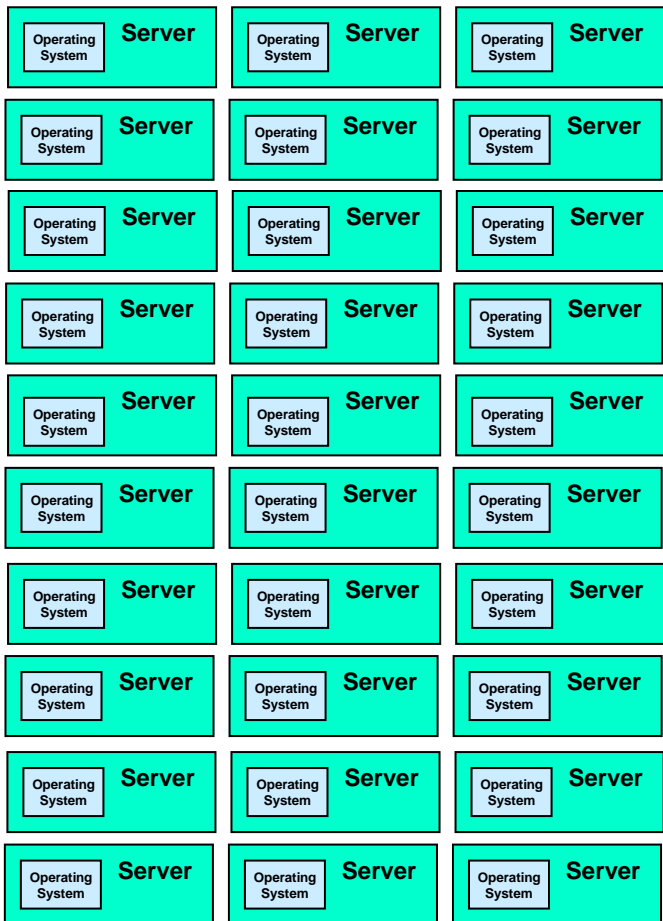
Server Virtualization in a Nutshell (part 7)



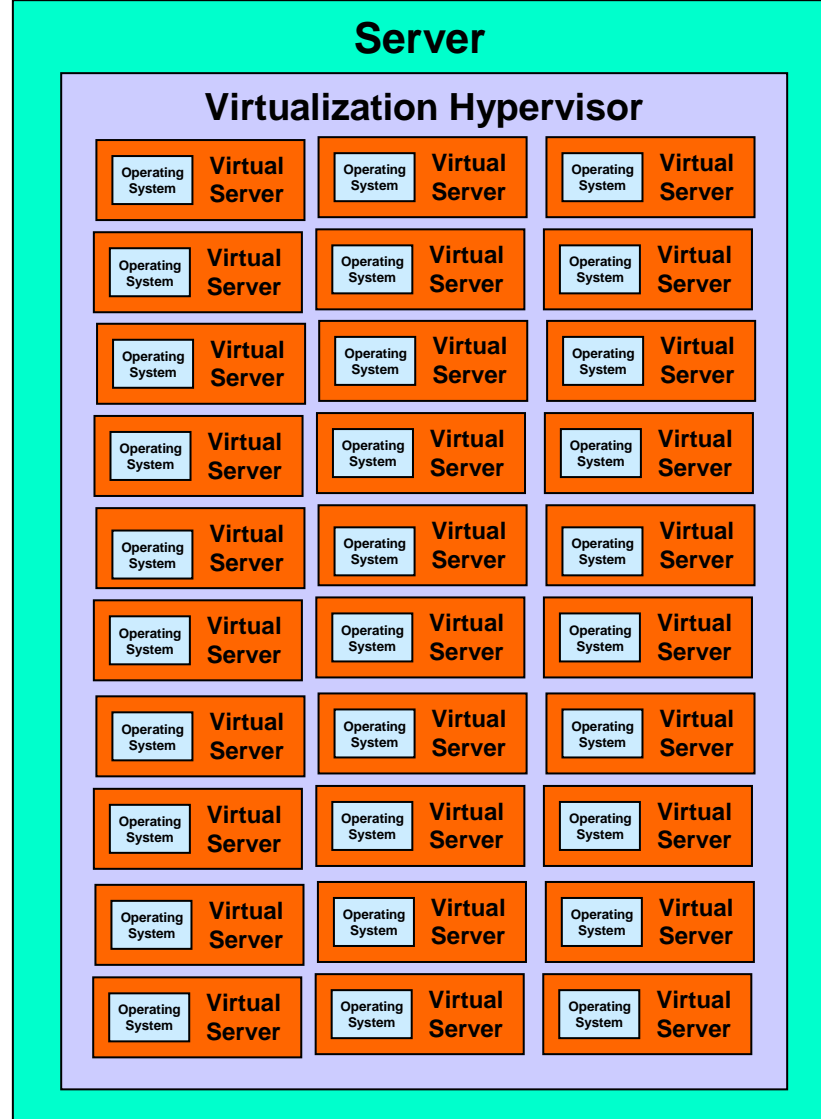
Server Virtualization ... the Big Promise



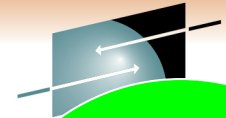
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Server Consolidation via Virtualization



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So Which Virtualization Technology is Best?

Which Server is Best?

It Depends...
On Time
Risk And
Money!

Which Hypervisor is Best?

It Depends...
On
Hardware

It Depends...
On
Software

It Depends...
On
Hypervisor

It Depends...
On
Quantity

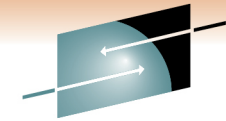
It Depends...
On
Workloads

It Depends...
On
Architecture

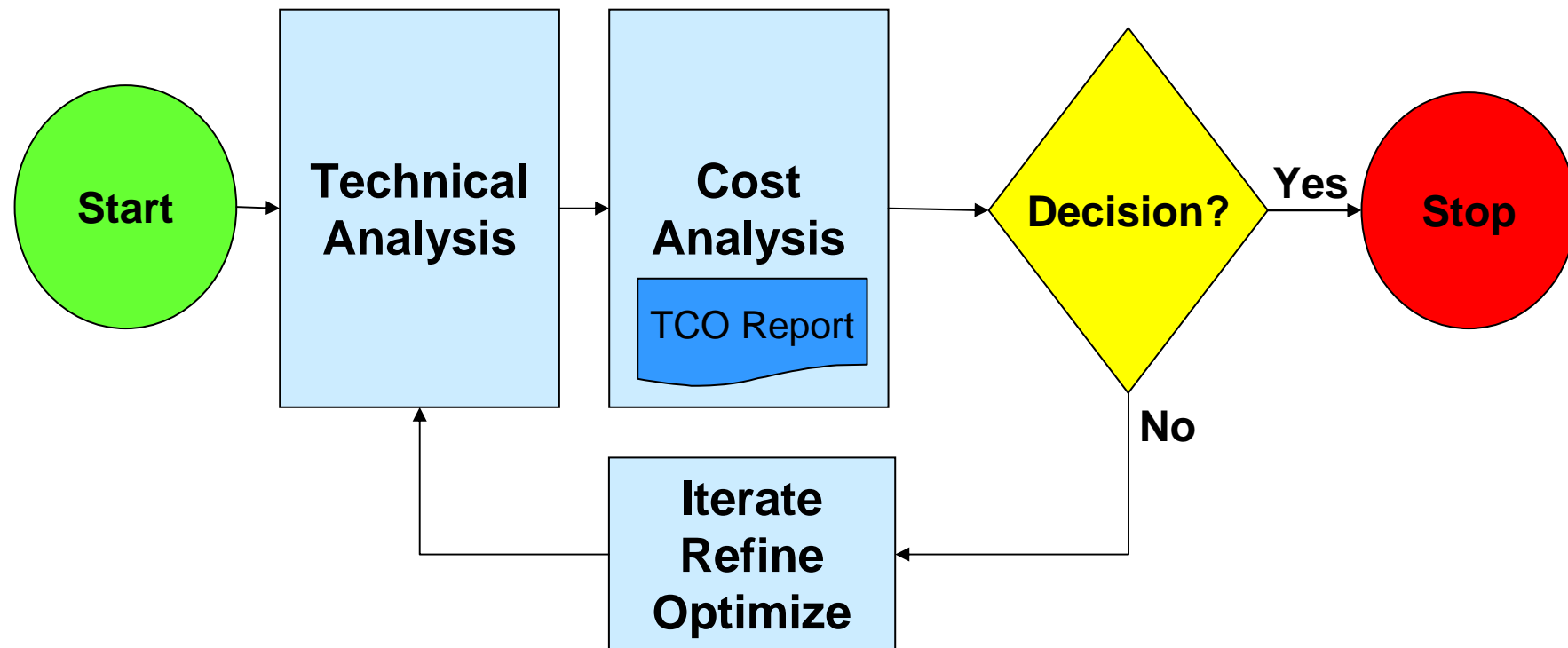
It Depends...
On
People

That's what "RACEv" is all about!

Helping to turn questions into answers

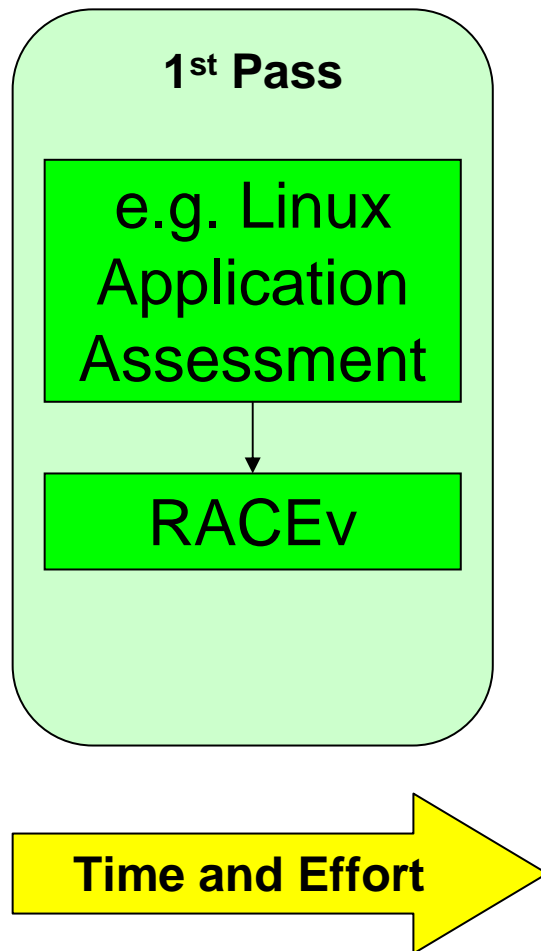


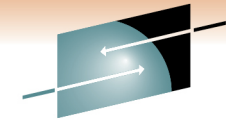
RACEv Analysis Methodology in a Nutshell



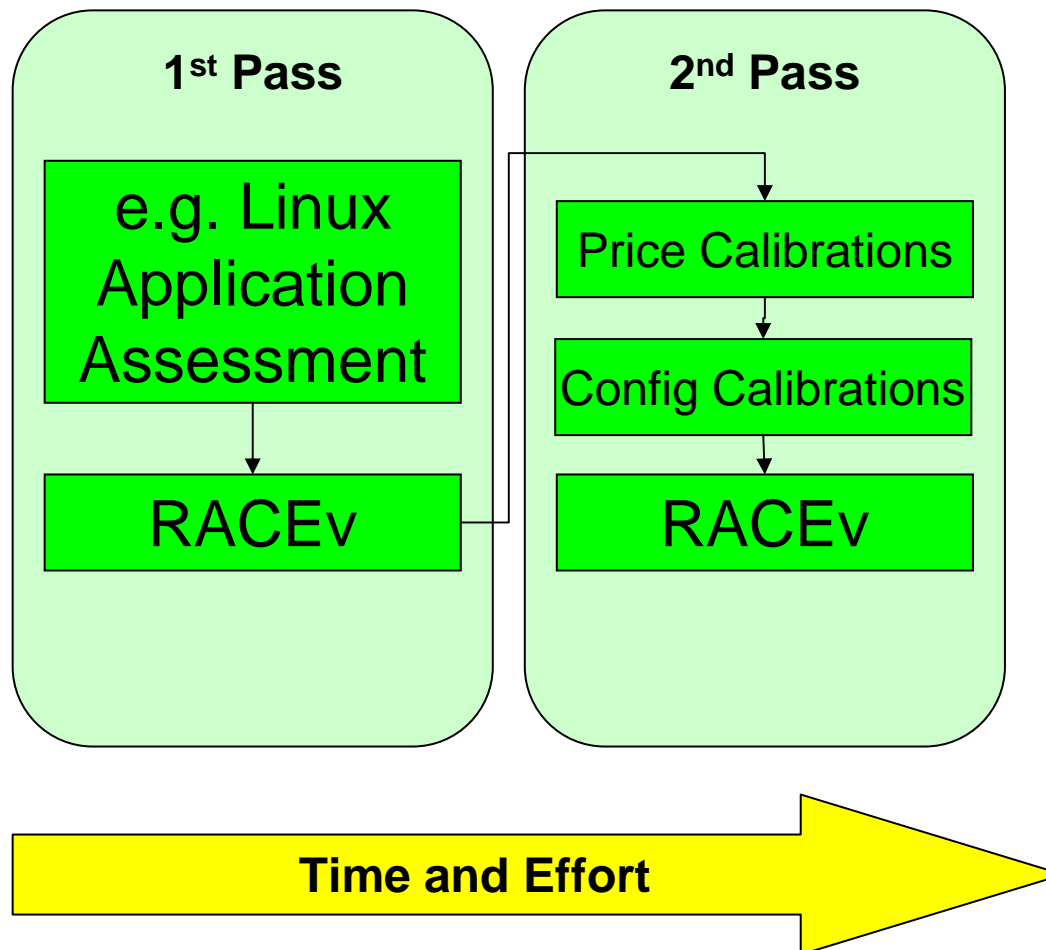
RACEv Analysis Integration Points

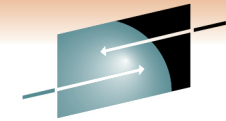
EXAMPLE



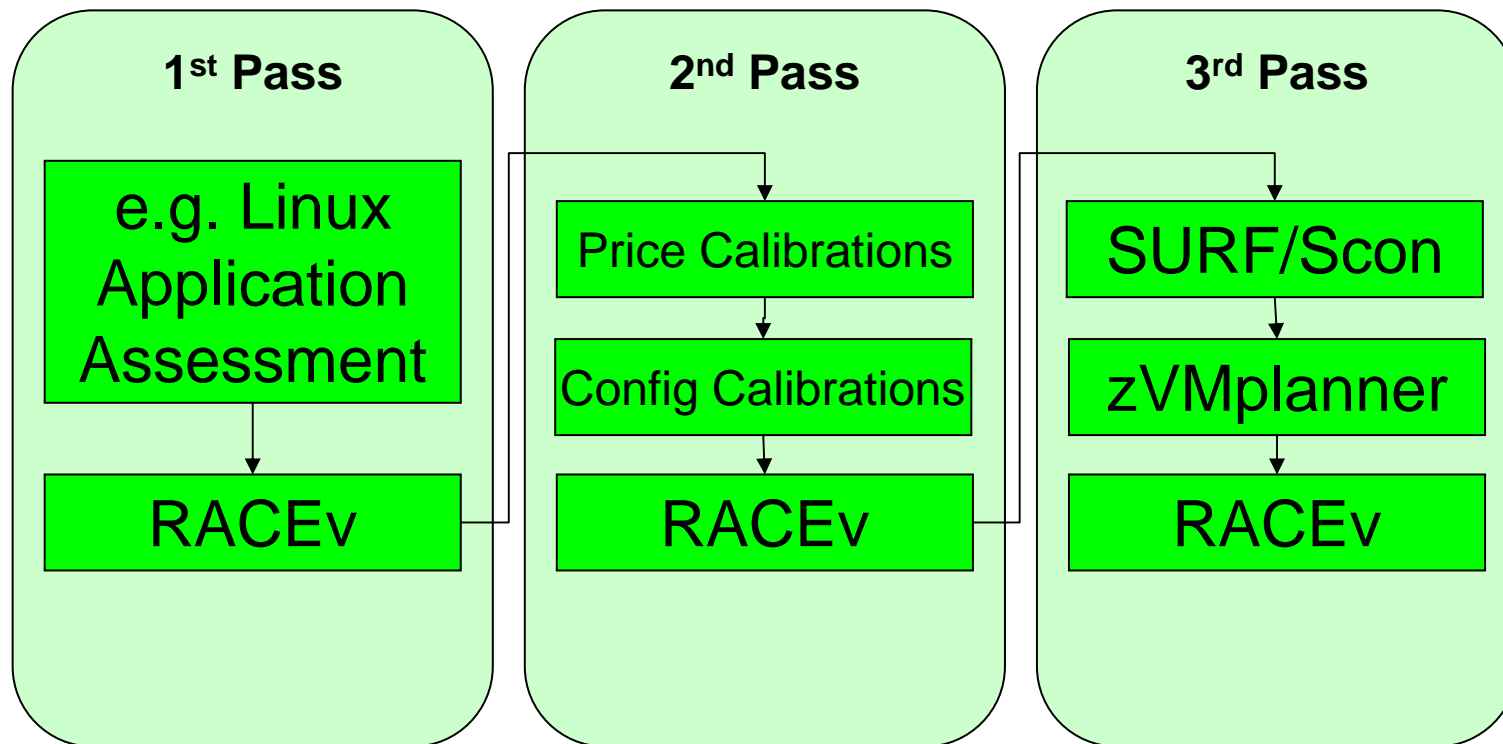


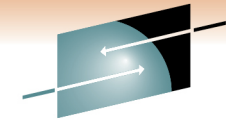
RACEv Analysis Integration Points EXAMPLE





RACEv Analysis Integration Points EXAMPLE





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RACEv Technical Analysis Categories

1. Virtualization Target Configuration Analysis
2. Processing Constraint Analysis
3. Memory Constraint Analysis
4. Hypervisor Constraint Analysis
5. I/O Configuration and Connectivity Analysis
6. Enterprise Backbone Bandwidth Analysis
7. Software Analysis
8. Hypervisor Software Analysis
9. Datacenter Analysis
10. Systems Administration Analysis
11. Engineering and Migration Analysis *
12. Datacenter Facilities Analysis *

*** RACEv provides “placeholders’ for these analysis efforts**
(i.e. RACEv does not support the analysis directly, but does so indirectly)

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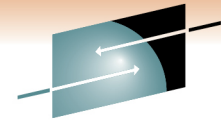
RACEv Cost Analysis Categories

1. Power
2. Floorspace
3. Facilities *
4. Migration *
5. Engineering *
6. Server Acquisition
7. Server Maintenance
8. Connectivity Acquisition
9. Connectivity Maintenance
10. Disk Acquisition
11. Disk Maintenance
12. Software Licenses
13. Software Maintenance
14. Network Bandwidth
15. Systems Administration
16. Disaster Recovery
Equipment Acquisition
17. Disaster Recovery
Equipment Operation
18. Cost of Downtime
19. Cost of “Solution Editions”

*** RACEv provides “placeholder-inputs’ for these cost category inputs**
(i.e. RACEv does not generate values for these categories)

Initiating a RACEv Engagement

- To begin a RACEv analysis (or to learn more about RACEv's applicability in your situation)...
 - Contact your IBM technical support specialist or sales specialist or Techline
 - ...and (as req'd) have them contact a RACEv core team consultant (below)
 - ...or engage Techline
 - http://w3-03.ibm.com/support/techline/na/dasmt_sysz.html
 - ...if you are a business partner, contact PARTNERWORLD
 - *available to distributors and Dynamic Infrastructure Specialty or Specialty Elite partners*
 - Paul Augustyniak ... paugusty@us.ibm.com (East)
 - Bob Vik ... revik@us.ibm.com (East)
 - Monte Bauman ... mbauman@us.ibm.com (East)
 - Scott Lundell ... solundell@us.ibm.com (West)
 - Eduardo Oliveira eduardoc@us.ibm.com (Techline)



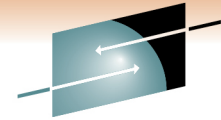
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The RACEv Modeling Methodology

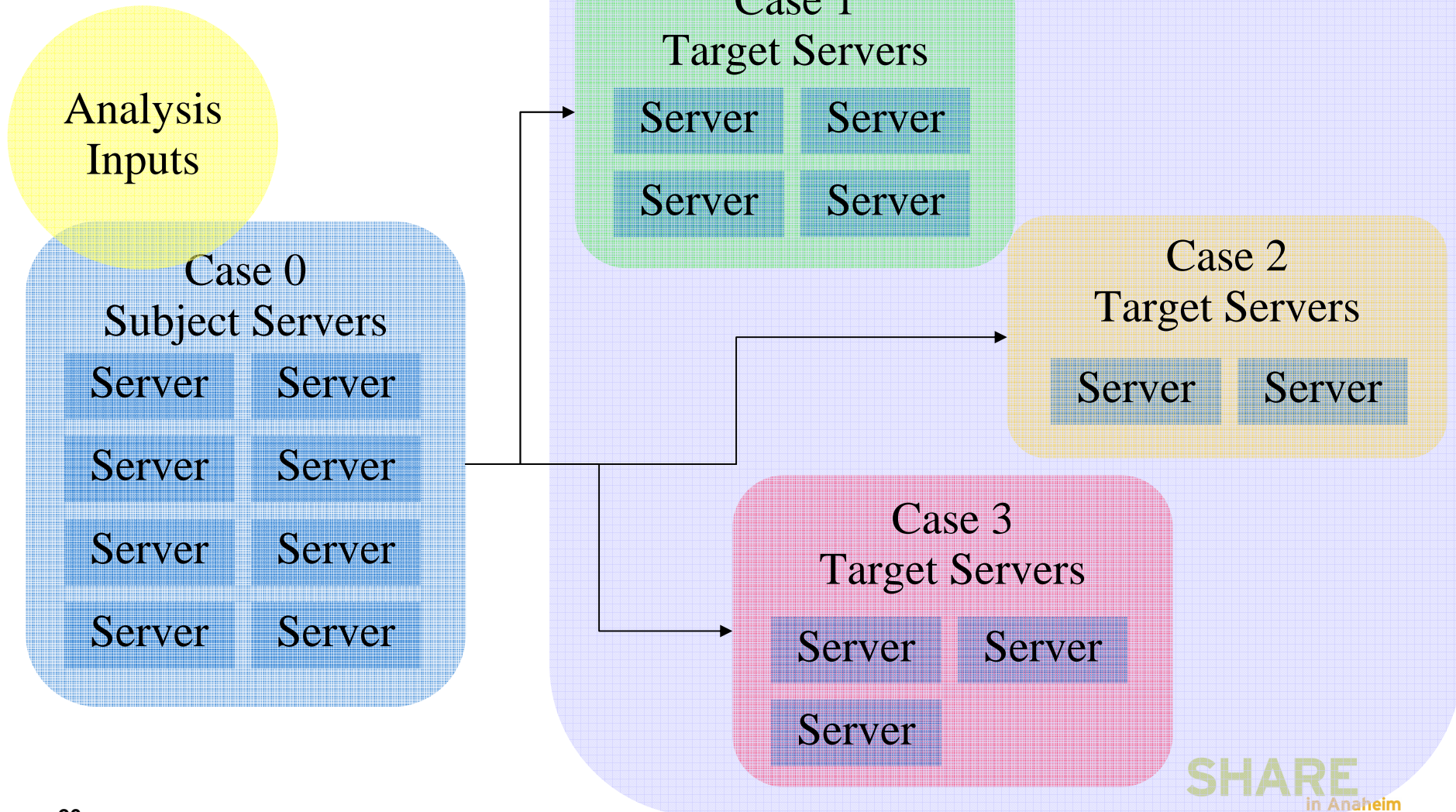
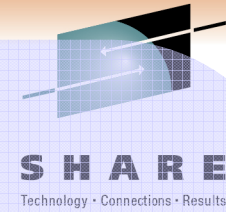


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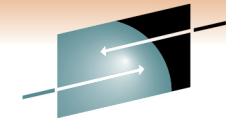
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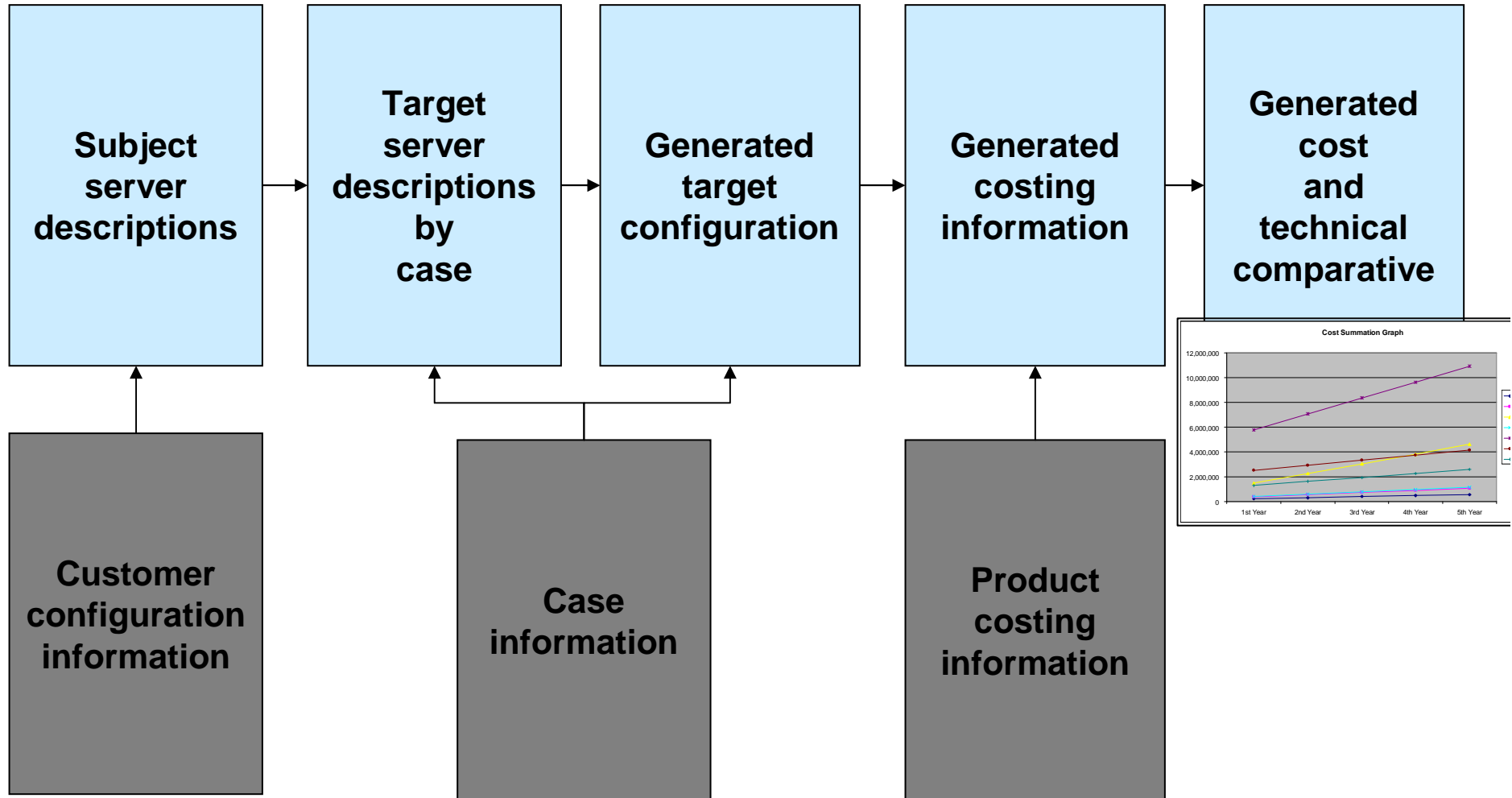
Analysis Summary



An Overview The RACE Modeling Methodology

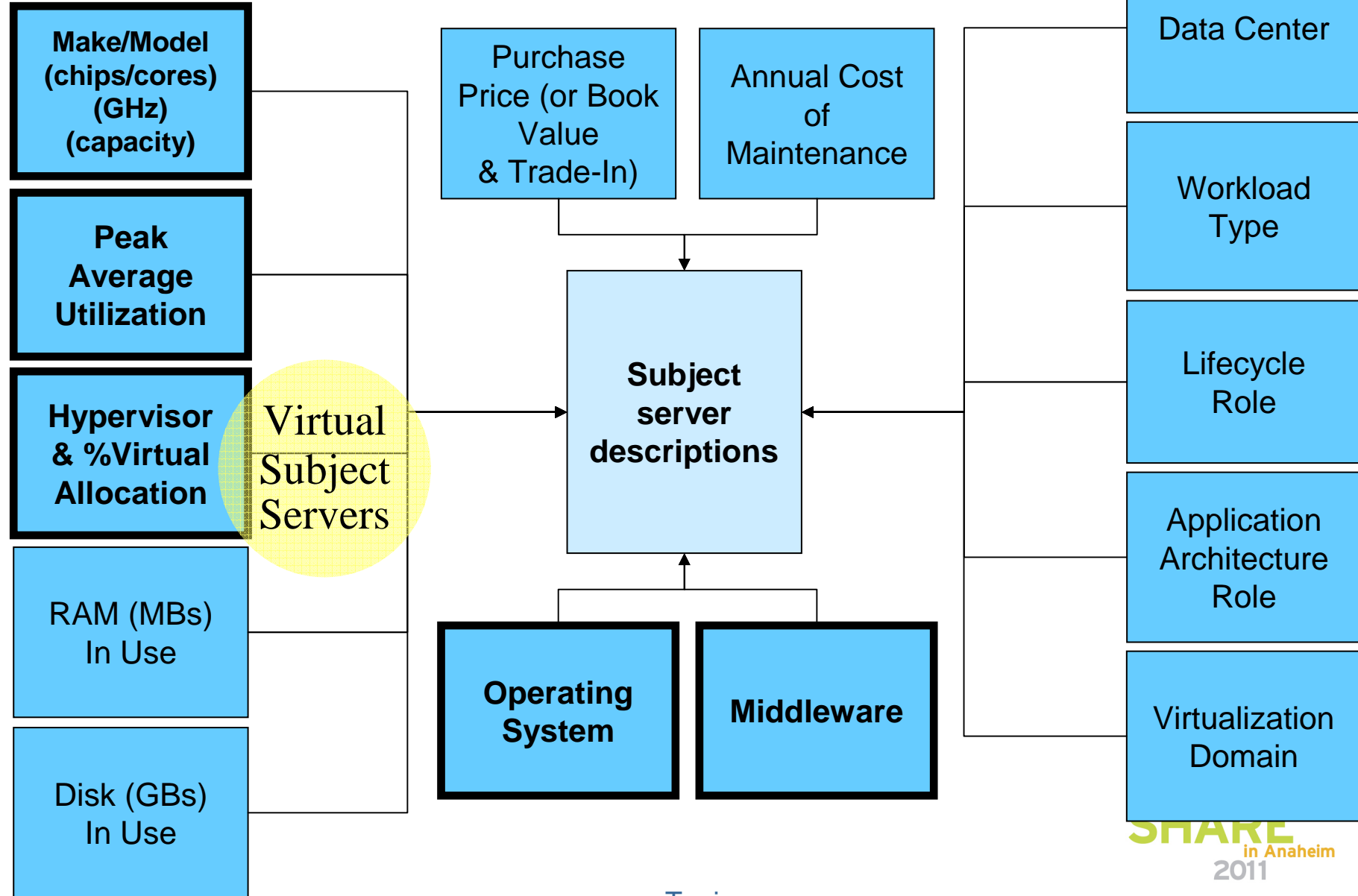


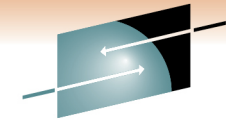
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Subject Server Descriptions





Server Data Used by RACEv

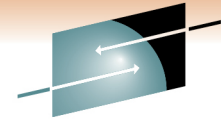
All Subject and Target servers (except for z) are described in a 3rd-party provided distributed-server data-table

- **Vendor** – e.g. “IBM”
- **Server Name** and Config Info – unique key
- **Family** – e.g. “System p” or “Proliant”
- **Model** – e.g. “p570” or “DL585”
- **Processor** – e.g. “Xeon X7350 Quad Core 2.93GHz”
- **Chips** – number of chips in config – e.g. “4”
- **Cores** – number of cores in config – e.g. “8”
- **Capacity Rating**
- **Height** – millimeters of height
- **Width** – millimeters of width
- **Depth** – millimeters of depth
- **Watts** – steady state power consumption (vs nameplate)

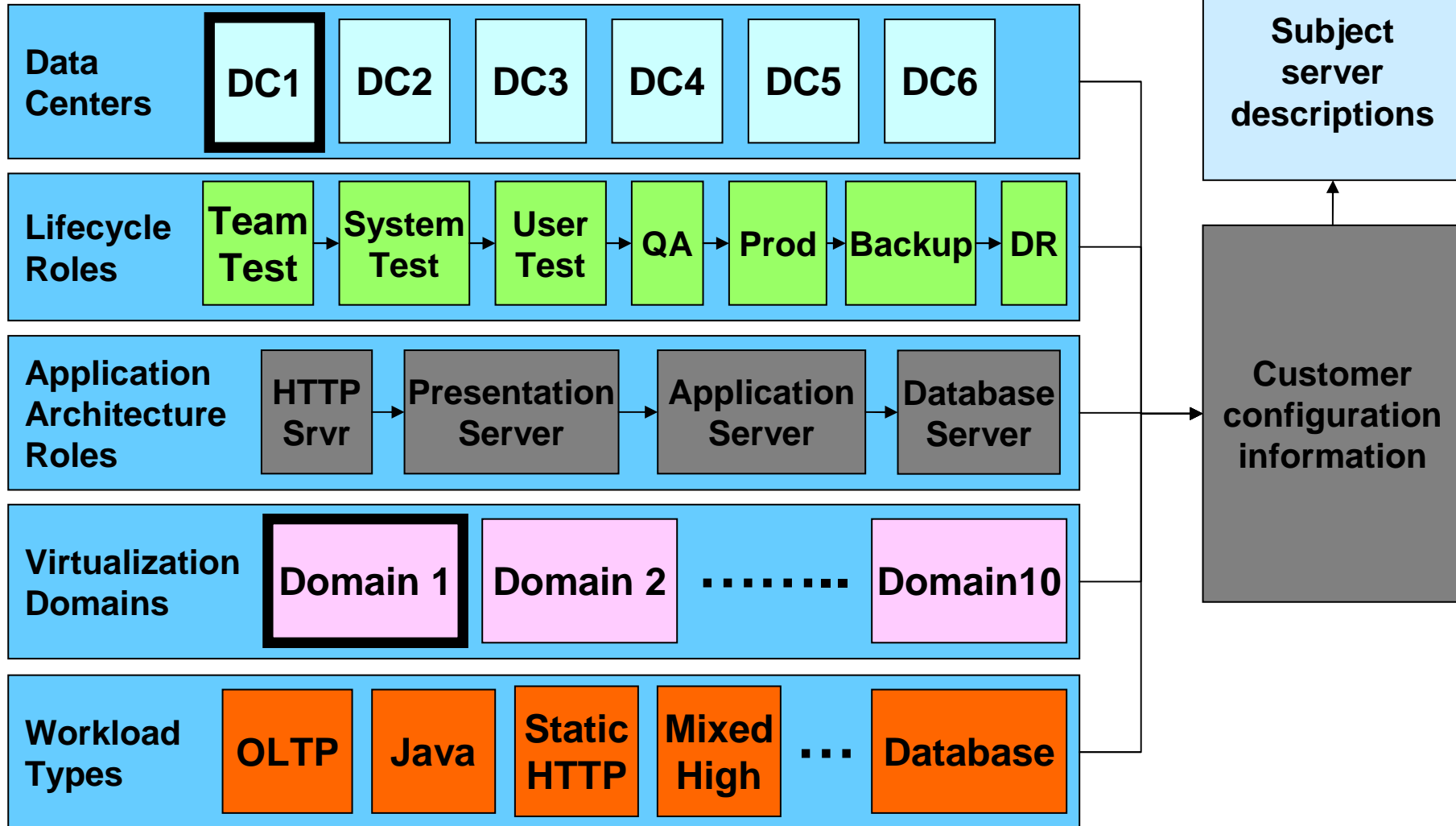
Used for Software Licensing & Costing Calculations

Used for
“Green” Analysis

Provided by independent company (non-IBM affiliated) ... 18K+ entries in table, all major vendors represented, all x86 & all RISC



Customer Configuration Information

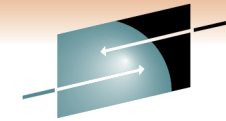


All above configuration information is customizable via simple table edits in the tool.

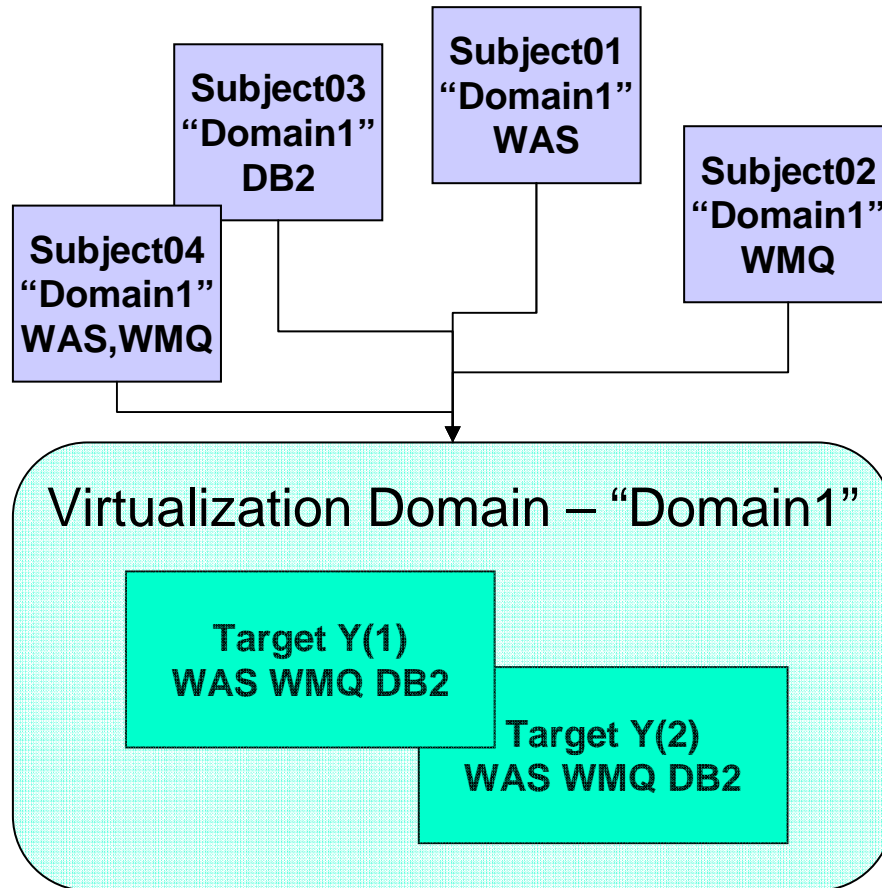
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Subject Server to Target Server Mapping

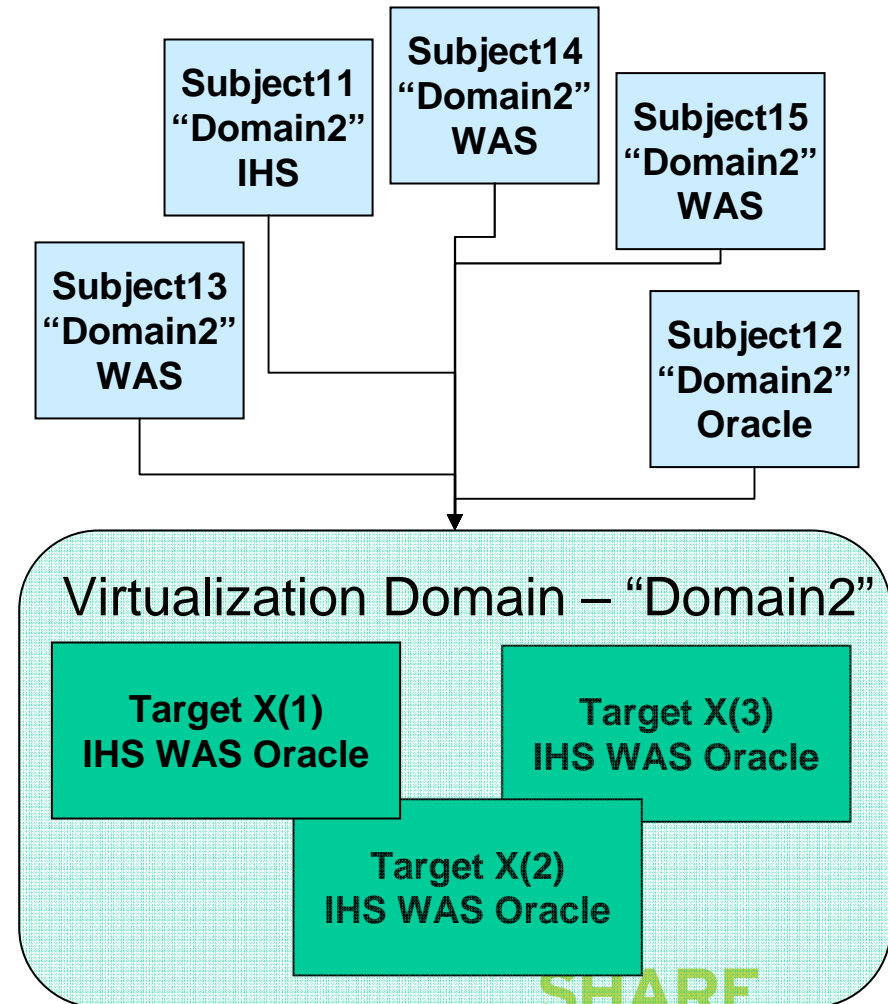
“Virtualization Domains”



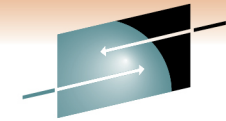
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1 to N Cloned Target Servers per Domain
(note how software is mapped and cloned)

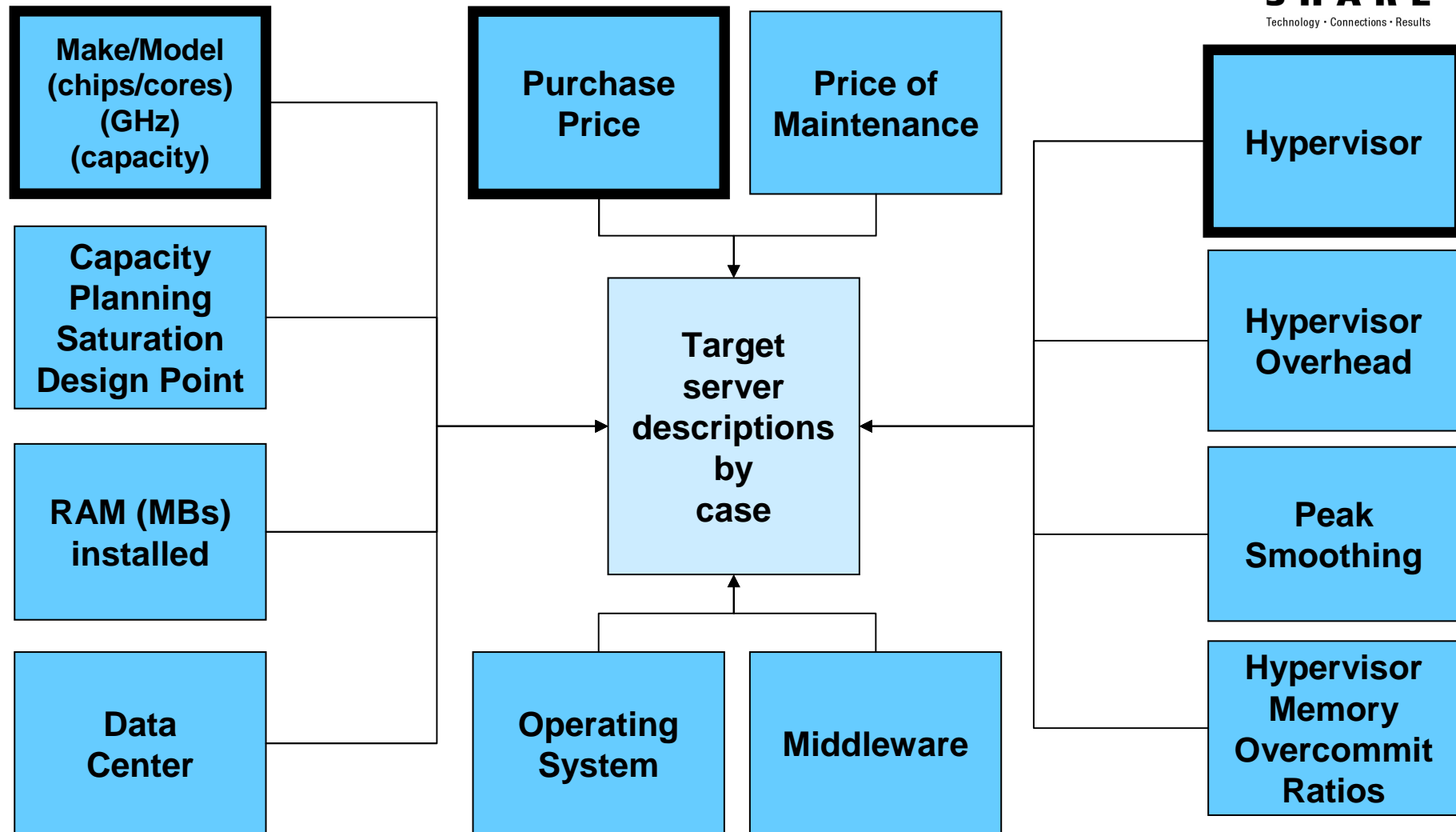


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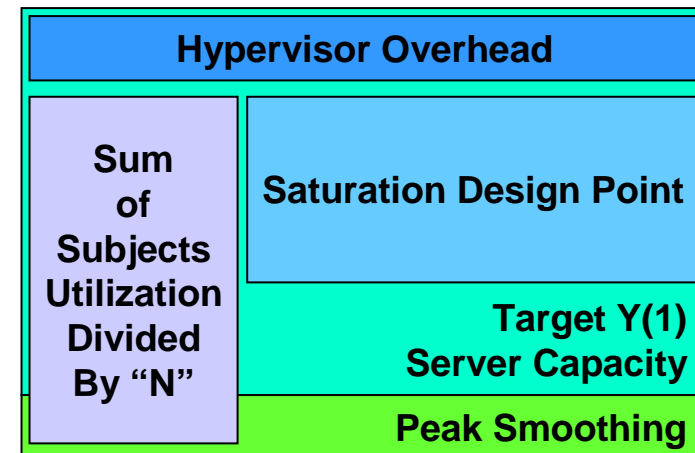
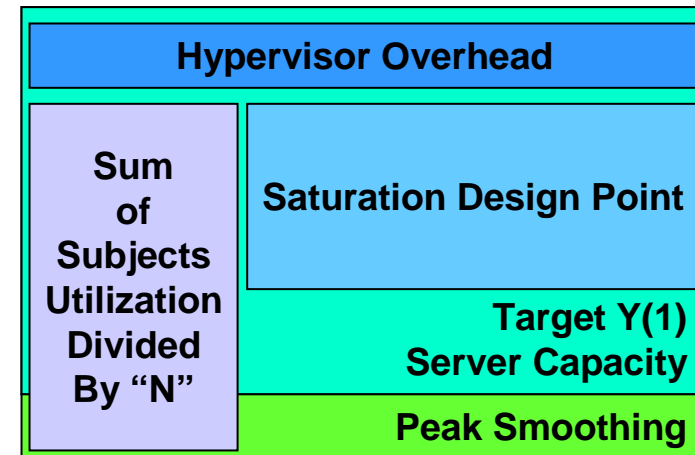
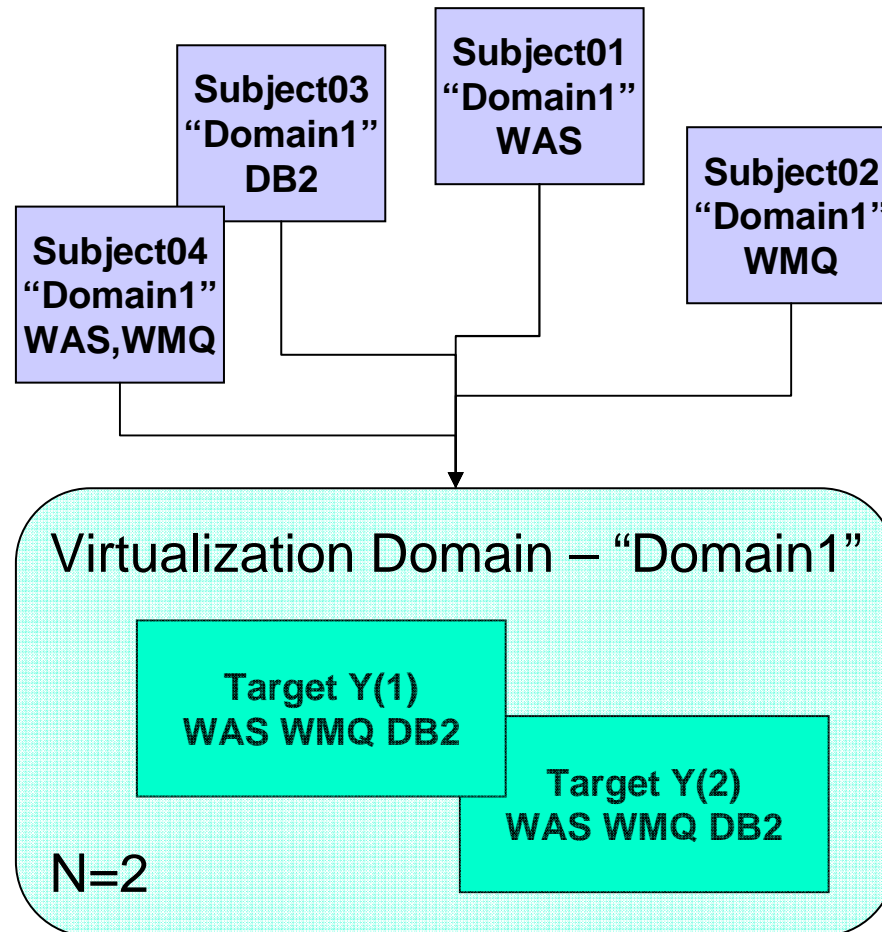
Target Server Descriptions



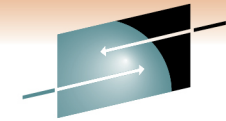
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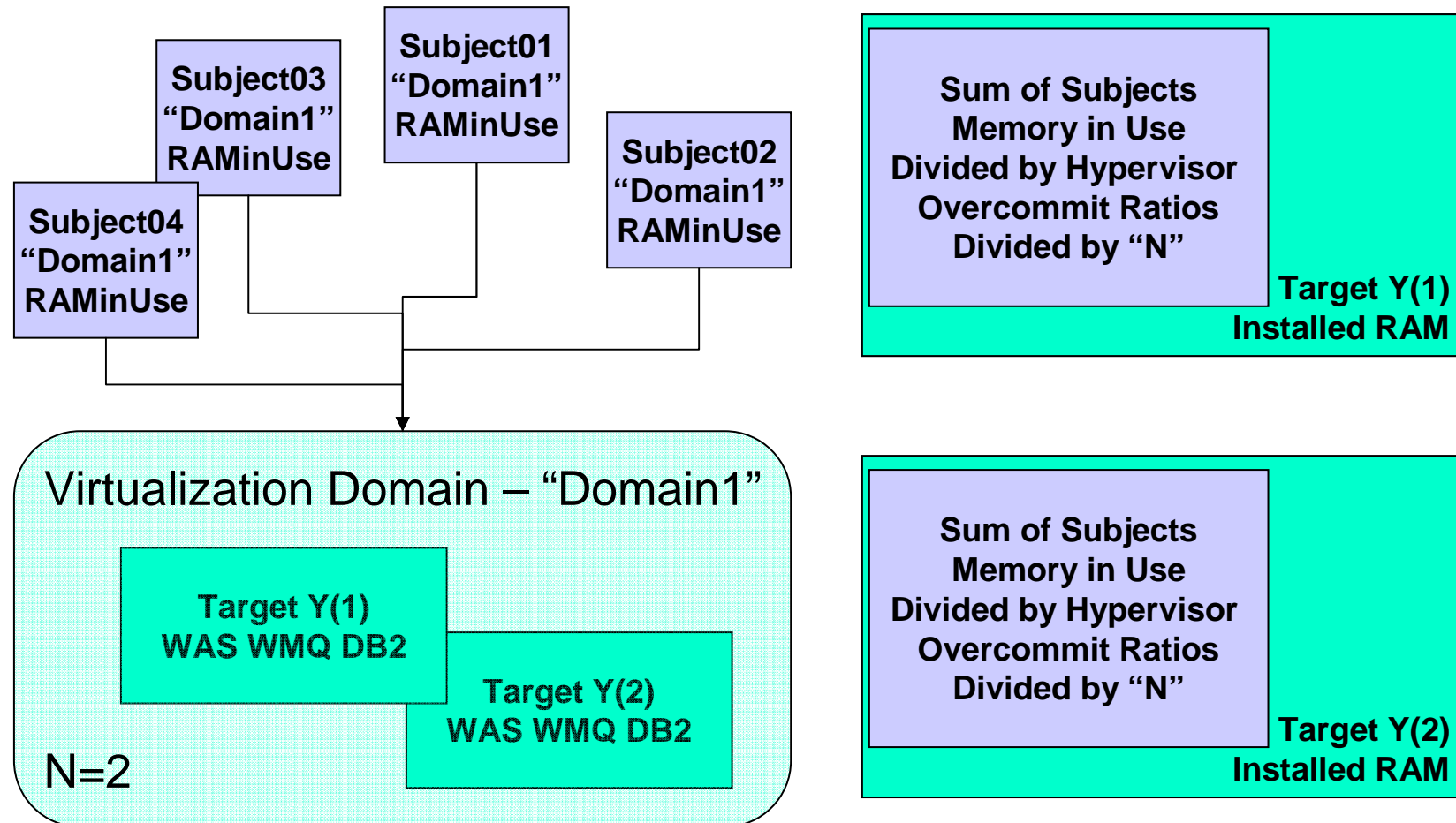
Target Server Processing Capacity Planning



N = Number of Target Servers Determined to be Required per Capacity Planning

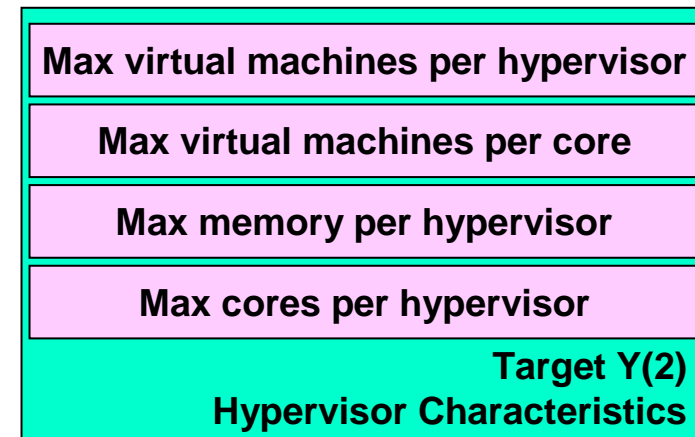
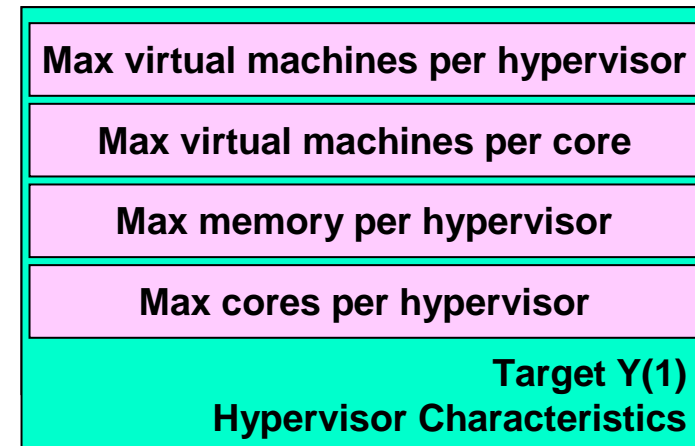
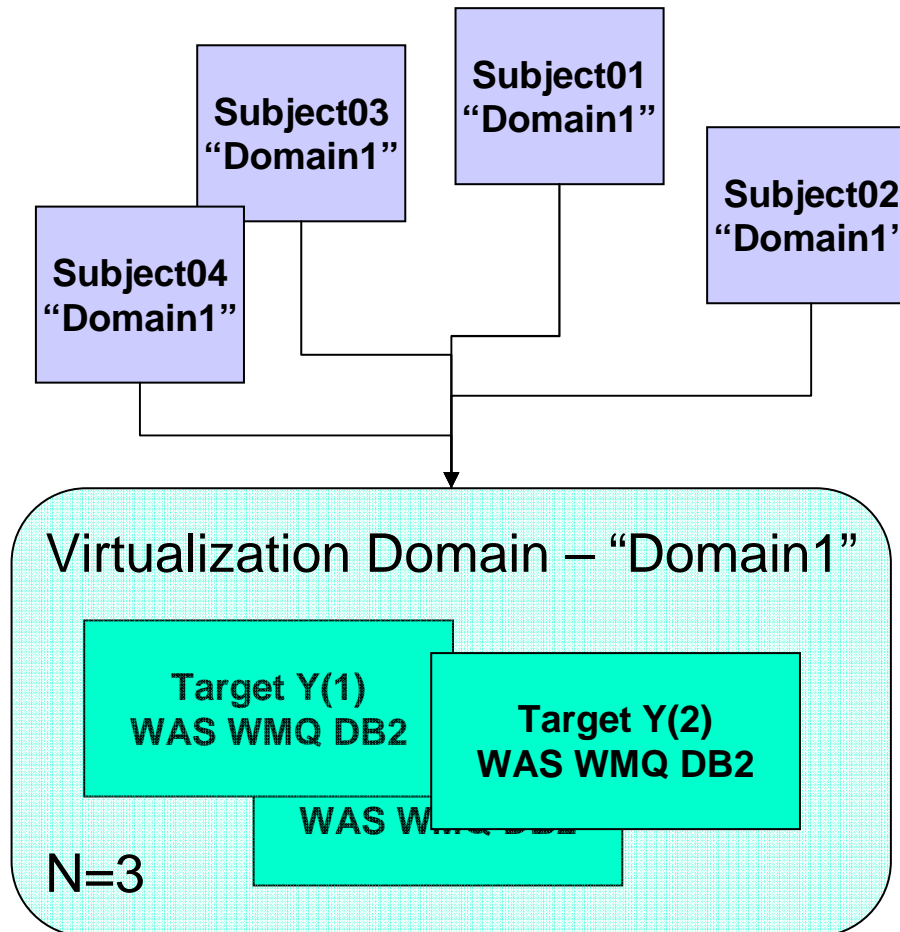


Target Server Memory Capacity Planning

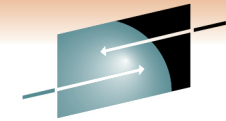


N = Number of Target Servers Determined to be Required per Memory Capacity Planning

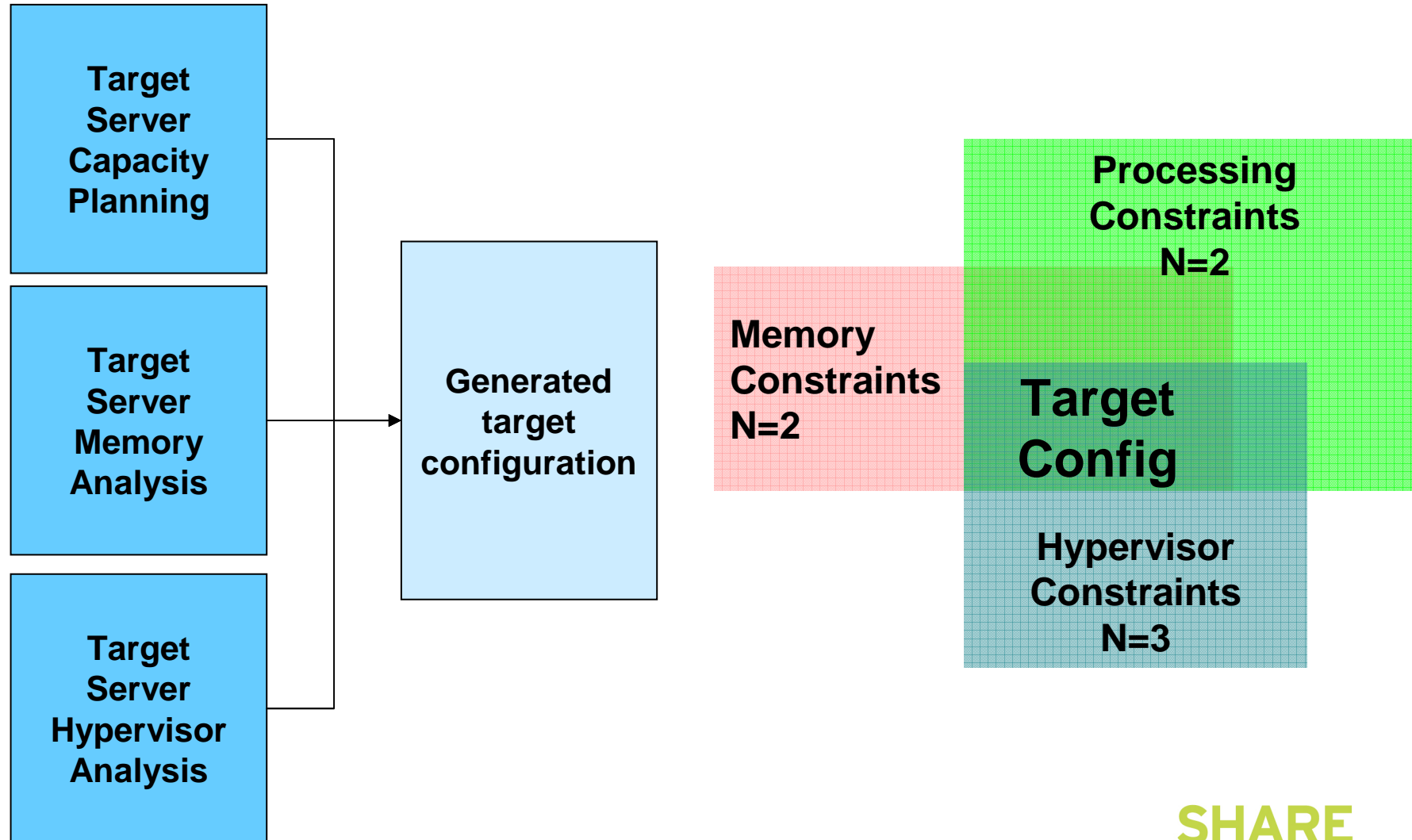
Target Server Hypervisor Capacity Planning



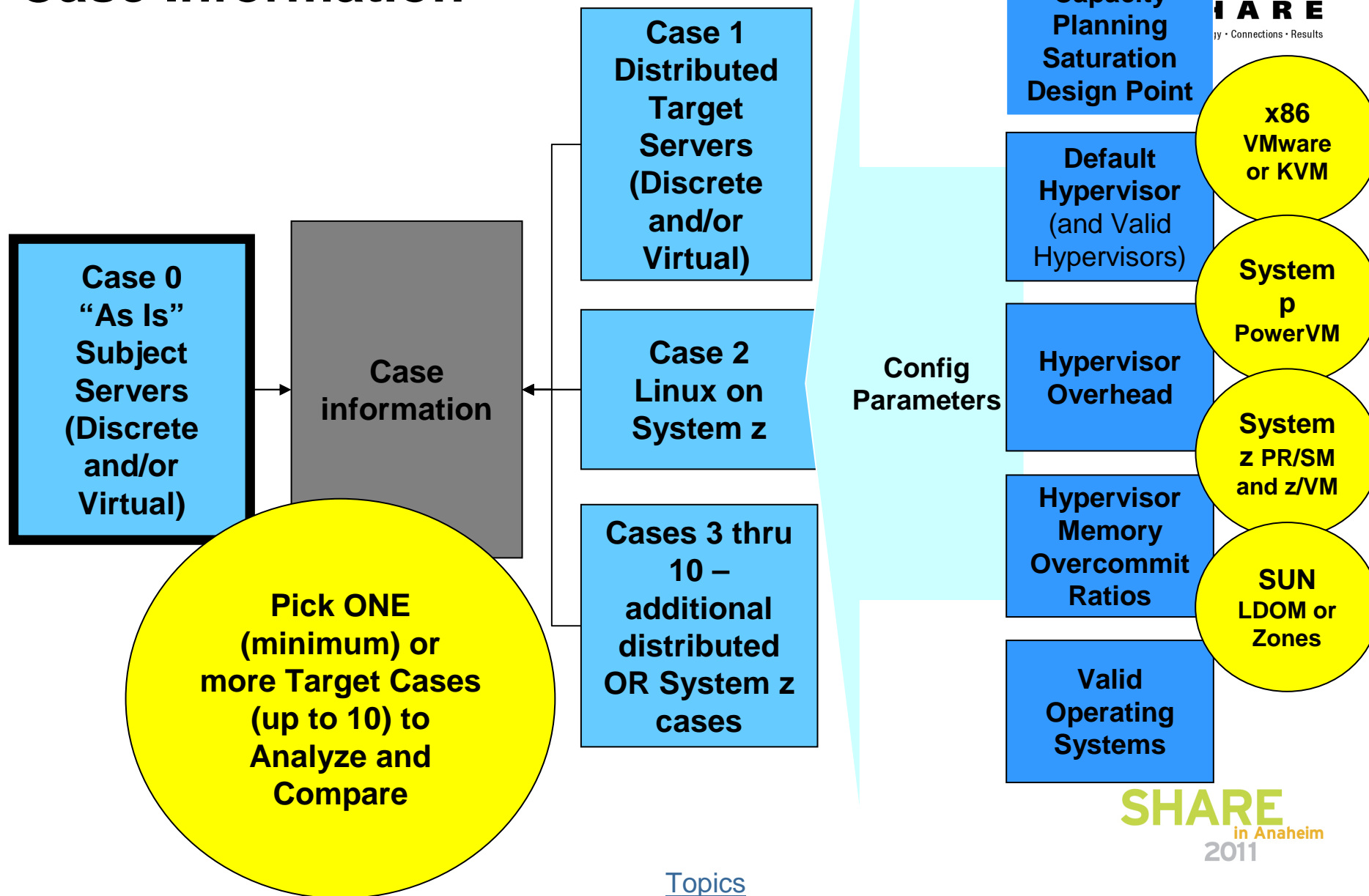
**N = Number of Target Servers Determined per Hypervisor
Characteristics (Constraints)**



Generated Target Configuration



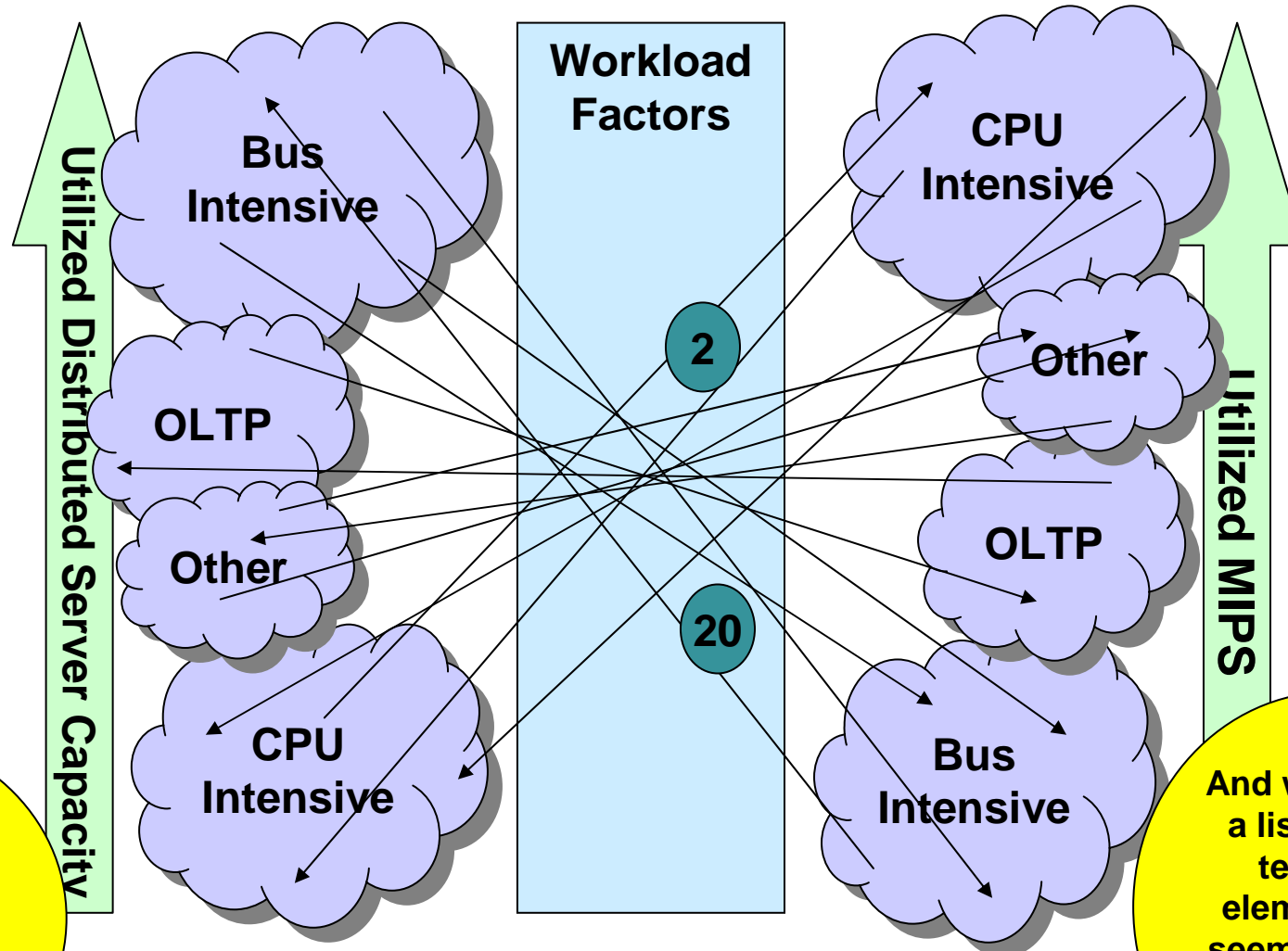
Case Information



System z Cross-Server Capacity Mapping

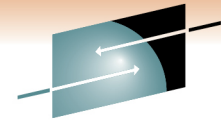
- Mainframes are designed a certain way ...
- Distributed servers are designed a certain way ...
- When designs do not vary greatly, then a commonly derived and consistently applied capacity metric is valid in order to correlate servers from various makers.
 - (We get such a metric from our 3rd party server database provider)
- Mainframes and distributed server designs do vary greatly!
 - A different (and patented) technique to correlate capacities is required!

Workload Factors ... Applying Technical Understanding



When we came to understand the workloads better, we added "labels" to the clouds

And we derived a list of the 6 technical elements that seemed best to drive the mapping



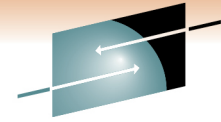
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RACEv Run-Through

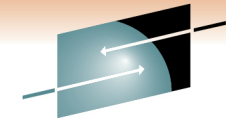


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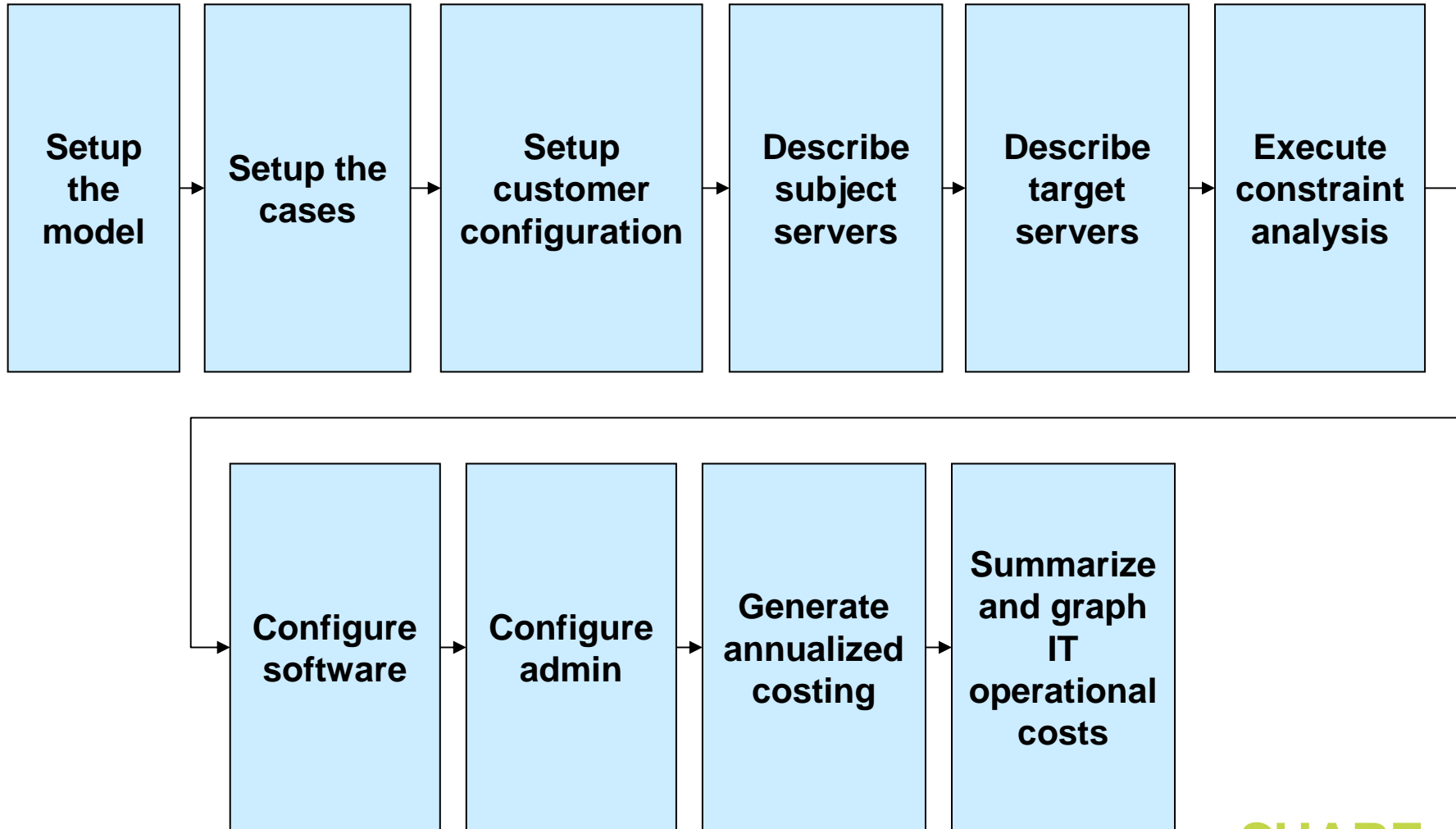
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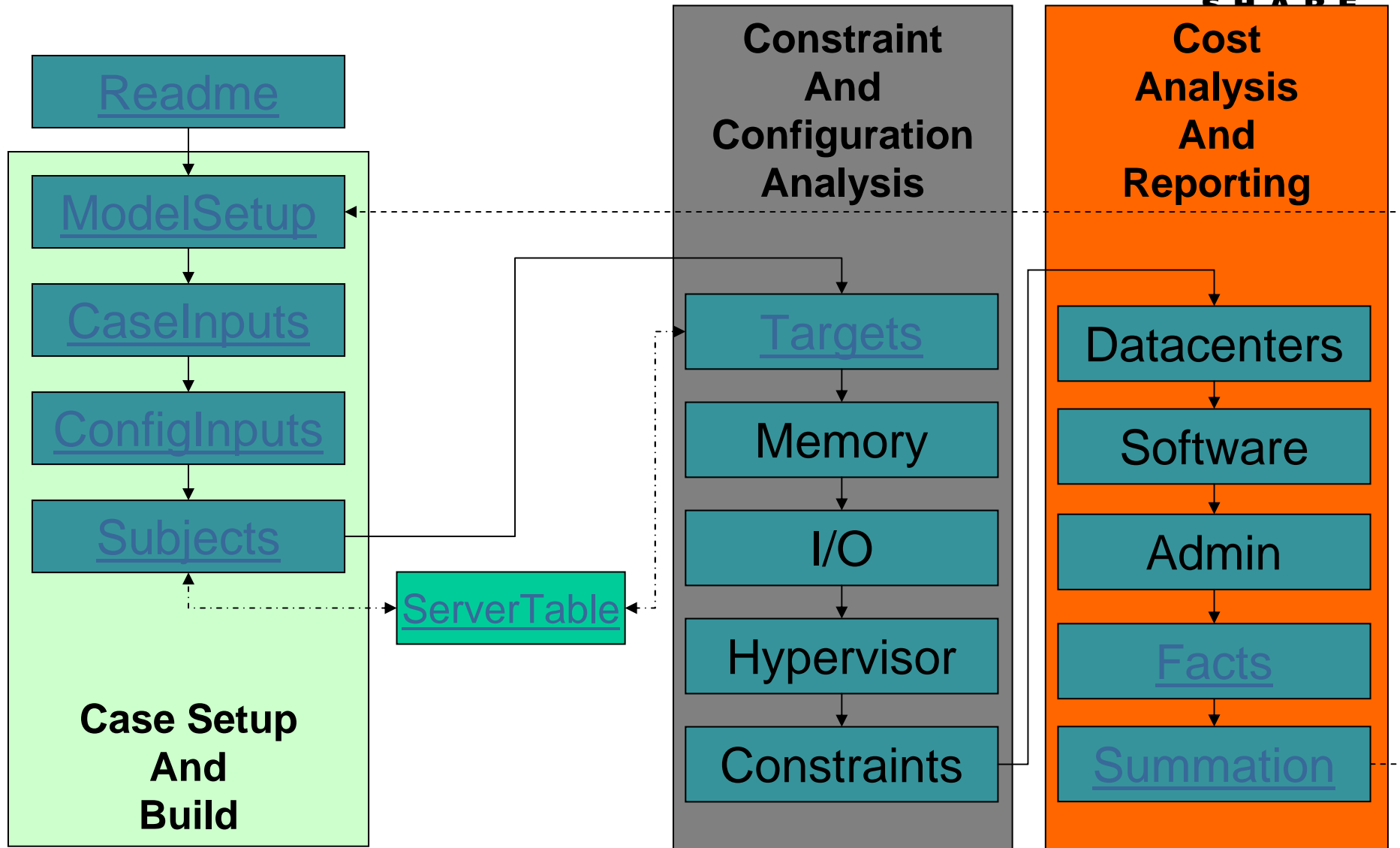
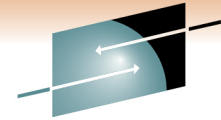
The RACEv Model in a Nutshell (process-view)



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RACEv Workflow (simplified “worksheet” view)



Readme Sheet

- Version Number & Filename
- Server Database Freshness Date
- Support Button
- Support List
- Feedback Button
- Submission Button
- Disclaimer
- Licensing Information and Instructions
- The Model in a Nutshell

RACEv - Server Virtualization Cost & Value Analysis Tool

Security and Compliance Information

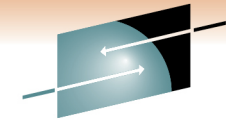
Security Classification: **IBM Internal Use Only**
Licensed Materials - Property of IBM
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Release Information

Version.Release: **1.4.1** Release Date: **27 July 2009**
Model Filename: C:\DATA\ES\Modeling\RACEv\[RACEv_20090727_V141.xls]Readme

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Model Setup

- Model Name
- Nickname
- Objective
- Result
- Brownfield / Greenfield Switch
- Pushbuttons (next page)

Case Controls

Input Fields Are Color Coded Like This	Common Inputs
Input Fields Are Color Coded Like This	Uncommon Inputs
Default-Value Override Fields are Color Coded Like This	Overrides
Key Output Fields are Color Coded Like This	Key Outputs
Key Notations are Color Coded Like This	Key Notations or sub-headers
Key Section Headers are Color Coded Like This	Headers
End of Input Demarkations are Color Coded Like This	End of Inputs

Model Run Setup Table

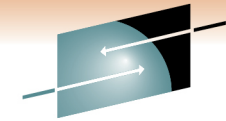
Model Name:

Model Name

Model Description/Objective:

Please use this input field to describe the objective of this model ... what is being studied ... what is be decided ... who is doing the work ... and what timeframes are at hand ...

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Model Setup - Pushbuttons

- Cell Protection On/Off (recommend “On”!)
- Reset Overrides
- Turn Cases on and off (just work the ones you care about)
- Turn Domains and/or Datacenters on and off
- Streamlines (by hiding) the workbook and working processes
- Set Normal-Mode / Hybrid-Mode

Model Controls and Assists

Use these buttons to enable or disable protection on the worksheet. Protection prevents accidental erasure of key fields. All input cells and overrides are fully accessible with protection on

Protection On

Protection Off

Press this button to reset (i.e. delete) all "Overrides"
Reminder: Overrides are the "tan" colored cells

Reset Overrides

Press this button to setup major model variables ...
... including the cases under consideration ...
... including the virtualization domains under consideration ...
... and including the datacenters under consideration

Case Setup

Press this button to increase the number of middleware titles per virtualization domain. The default is 10.

Config Added
Software

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Case Inputs

- Set Case IDs
- Pick Default Hypervisors per Case
- Set Basic Target Server Parameters per Case

Case Naming and Hypervisor Setup Table

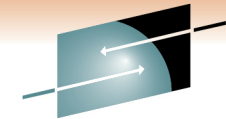
Case 0	Case 1	Case 2	Case 3	Case 4
		z/VM-5.3 + PR/SM	VMware ESX 2.0	p5 POWER Hypervisor
Subject Servers	Server Refresh	IBM System z	-	IBM System p
The as-is (or as would normally be done) case, with configuration consisting of standalone distributed servers	The "refresh case", with configuration consisting of same number of servers as base case (Case 0) but using different (usually more modern) standalone distributed servers	Server consolidation thru virtualization case using Linux virtual servers (in same number as base case (Case 0)) and using z/VM virtualization hypervisor and System z physical server (or servers)	Server consolidation thru virtualization case using WIN2K or Linux virtual servers (in same number as base case (Case 0)) and using VMware virtualiation hypervisor and x86-based physical server (or servers)	Server consolidation thru virtualization case using AIX or Linux virtual servers (in same number as base case (Case 0)) and using pHype virtualization hypervisor and POWER-based physical server (or servers)

Config Inputs

- Setup Datacenter Tables
- Setup Server Lifecycle Table
- Setup Virtualization Domains Table
- Setup Workload Factor Table
- Setup Operating System Table
- Setup Middleware Table
- Setup System z Performance, Cost, & Power Tables

Key Software (and zHardware) Inputs Panel

Distributed Server Operating Systems Table						
Titles	Cost Per Server License	Cost Per Server S&S	Cost Per Virtual Image License	Cost Per Virtual Image S&S	Cost Per Socket License	Cost Per Socket S&S
WIN2K	0.00	0.00	0.00	0.00	0.00	0.00
Linux/x86+RISC	291.00	958.33	0.00	0.00	0.00	0.00
AIX	0.00	0.00	0.00	0.00	0.00	0.00
HP/UX Ent.	0.00	1,395.00	0.00	0.00	0.00	0.00
Solaris	0.00	0.00	0.00	0.00	0.00	0.00
VMware ESX	0.00	0.00	0.00	0.00	0.00	0.00
Linux/z	0.00	0.00	0.00	0.00	0.00	0.00



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Subjects Sheet

- Describe each “Case 0” server
 - Greenfield = to be acquired servers
 - Brownfield = existing servers
- Set Server Name
- Server Table “Lookup Number”
 - Server make/model chips/cores GH :
 - Watts Width Height Perf-Rating
- Set Quantity
- Set Peak Average Utilization
- Pick Server Lifecycle Role
- Pick Operating System
- Pick Primary Middleware
- Pick Other Middleware
- Pick Workload Factor
- Cost / Book Value / Trade-In / Maint.

Subject Servers Input Sheet

Specify your server inventory here...

5	0	Server Number 1
	Server Name (or Server Group Name)	ServerName
	Server Database Lookup Index	4971
	Vendor	HPQ
	Server Name and Config Info	ProLiant DL380 G3 (2U) Xeon 2.8GHz 512KB (2ch/2co)
	Family Model	ProLiant DL380 G3
85	Number of Servers	10
	Peak Average Utilization	10%
	Data Center Name	DataCenter01
	Virtualization Domain	Domain 1
	Server Lifecycle Role	Dev/Test
	Server Tier Role	Application Server
	Operating System	WIN2K
	Primary Middleware	WAS-ND
	Middleware 2	Oracle Enterprise Edition
	Middleware 3	null
	Middleware 4	null
	Middleware 5	null
	Middleware 6	null
	Middleware 7	null
	Middleware 8	null
	Middleware 9	null
	Middleware 10	null
	Workload Factor Category Specification	Middleware-Based Default
	CompeteLine	
0.00	Current Point in Time Server Book Value (or if Green-Field then the Cost of the Server) - Need help? - Invoke CompeteLine!!!	0.00
0	Depreciation Schedule Duration (Months)	0
0	Months Left in Depreciation Cycle	0
0.00	Current Point in Time Server Trade-In Value	0.00
90,000.00	Annual Server Maintenance per Server	1,500.00
	Warranty Period (for Green-Field / New servers)	0

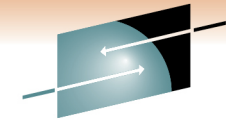
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Targets Sheet

- Per Virtualization Domain...
- Choose Target Servers
- Sizing Analysis
 - Determine how many target servers are needed to satisfy processing demands
- Set Costs
- Set Max Memory
- For z
 - Choose target z famil
 - LPAR-based sizing
 - Override #LPARs
 - Override #CECs

Target Server Setup and Processing Co

Case 1	No Hypervisor	Server
Server Domains:	Domain 1	Domain 2
High Priority OLTP_RPEs	19539	0
Medium Priority OLTP_RPEs	0	0
Low Priority OLTP_RPEs	6796	0
Total OLTP_RPEs	26335	0
Minumum OLTP_RPEs for Hosting Server	619.6352941	0
Hosting Server Name	NewServer	NewServer
Server Table Index Lookup	5232	5232



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Facts Sheet

- Annualized Costs By Category ...
 - Power
 - Floor Space
 - Facilities
 - Server Acquisition
 - Connectivity Acquisition
 - Disk Acquisition
 - Annual Server Maintenance
 - Annual Connectivity Maintenance
 - Annual Disk Storage Maintenance
 - Software Licenses
 - Annual Software Support
 - Annual Enterprise Network
 - Annual Sysadmin
 - Disaster Recovery Equipment Acquisition
 - Total Annual Cost of DR Equipment
 - Annual Cost of Downtime Time

Facts and Figures Sheet

Introduction

	Case 0 Mixed Subject Servers	Case 1 DEL PowerEdge
Manufacturer/Vendor	-	-
Server/Model	-	-
Hypervisor	-	-
Virtual Servers	-	-
Physical Servers	1	1
Virtual Servers/Physical Server LPARs	-	-
Total IFLs Required in Virtual Domains	-	-

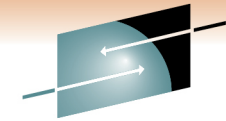
Power Analysis

	Case 0 Mixed Subject Servers	Case 1 DEL PowerEdge
Manufacturer/Vendor	-	-
Server/Model	-	-
Hypervisor	-	-
DC1	328.68	422.58
DC2	0.00	0.00
DC3	0.00	0.00
DC4	0.00	0.00
DC5	0.00	0.00
DC6	0.00	0.00
DC7	0.00	0.00
DC8	0.00	0.00
DC9	0.00	0.00
DC10	0.00	0.00

Total Annual Cost of Energy 328.68 422.58

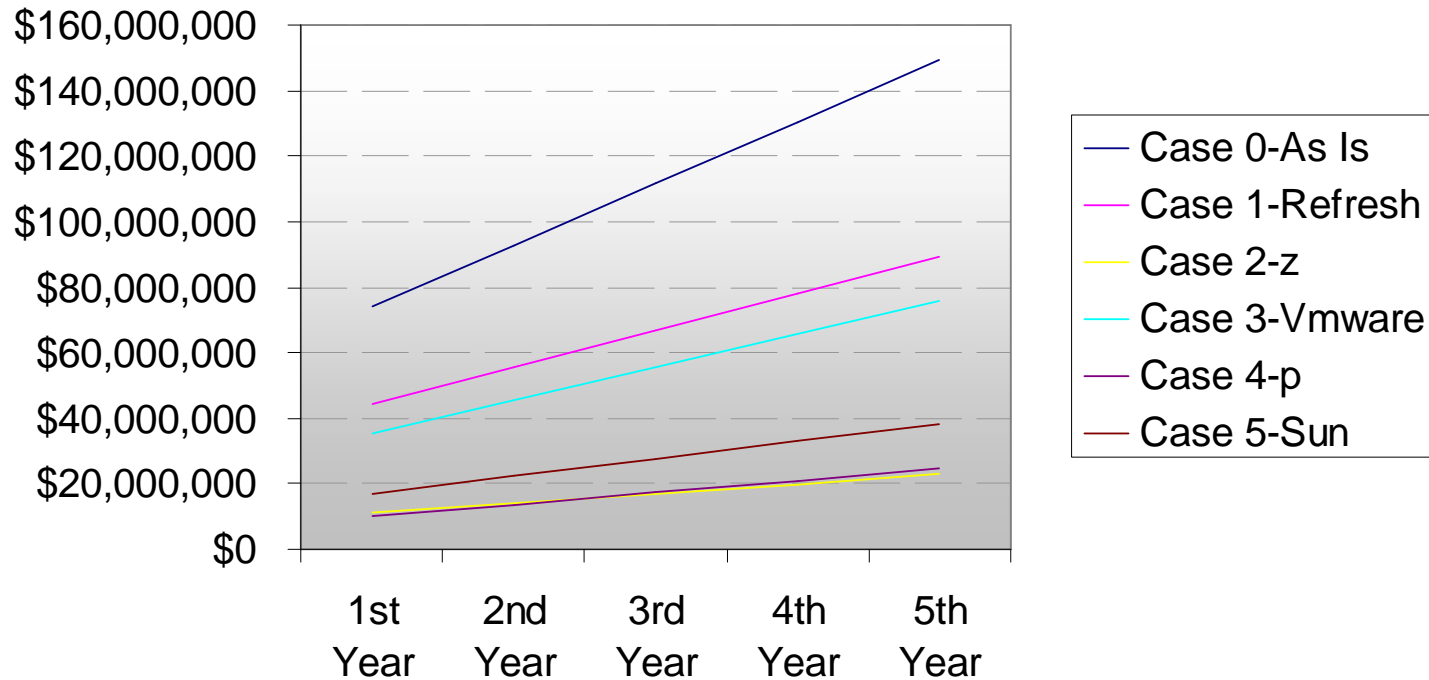
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Summation Sheet

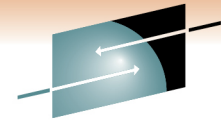


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RACEv Cost Analysis



Case ID	1st Year	2nd Year	3rd Year	4th Year	5th Year	Rank
Case 0-As Is	\$73,881,248	\$92,687,237	\$111,493,225	\$130,299,214	\$149,105,203	6
Case 1-Refresh	\$44,435,000	\$55,603,045	\$66,771,091	\$77,951,636	\$89,132,182	5
Case 2-z	\$11,130,700	\$14,045,991	\$16,961,282	\$19,876,573	\$22,791,864	1
Case 3-Vmware	\$35,406,280	\$45,462,191	\$55,518,102	\$65,574,012	\$75,629,923	4
Case 4-p	\$9,975,634	\$13,602,622	\$17,229,609	\$20,856,597	\$24,483,585	2
Case 5-Sun	\$17,013,054	\$22,307,805	\$27,602,557	\$32,897,309	\$38,192,061	3



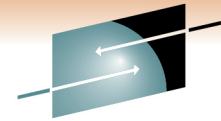
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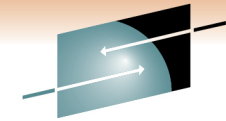
Additional RACEv Functions and Features



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Sensitivity Analysis

- The Favorite Sheet
 - Basic “What if” iterative analysis capability
 - Copy-by-value of “key” modeling outputs
 - As many times as required
 - Then compare run by run by run side-by-side
 - Watch key output variables change
- Sensitivity-Driver Spreadsheet
 - Choose RACEv inputs to vary (and how)
 - Choose RACEv outputs to watch
 - Run the driver
 - Which runs RACEv over and over and over
 - Changes inputs and records outputs
 - Creates a record of the runs and processes results
 - Read the report
 - Find what matters ... and what doesn't
 - Iterate and Decide

Technology Refresh Analysis

- Commodity servers...
 - Acquired in a 36-month pattern
 - Purchased with 36-month maintenance package
 - At end of term “Refreshed” with new commodity server
- RACEv
 - Will add estimated “acquisition costing” for a Tech Refresh
 - Will add estimated “admin” burden for a Tech Refresh

Growth Analysis

- As is, RACEv is a “static” analysis
 - What if the “requirements” (i.e. the subjects) are growing?!?!
- RACEv Growth Analysis
 - Permits user to specify rates of growth
 - To be applied to year 1 (applied to the “Subjects” sheet)
 - For each out-year (year 2, year 3, year 4, and year 5)
 - RACEv iterates and generates a new SUMMATION sheet based upon the specified growth rates

Solution Edition Package Support

- New “packaged” offering
- Complete “solution” package
- Hardware, software, maintenance, and options

- For “zLinux”, the “Enterprise Linux Server” (ELS) Solution Edition is applicable (there are many others)
- When the “zLinux” target configuration meets pre-requisites for ELS...
 - then RACEv will automatically use ELS package and prices

Hybrid Analysis

- **Normal-Mode**
 - All “Subject Servers” moved to “Target Case” and costed
 - Each “Target Case” compared to “Subject Case”
 - And each “Target Case” compared to any other generated “Target Cases”
- **Hybrid-Mode**
 - Each “Subject Server” moved to **ONE** “Target Case” and costed
 - Participating “Target Cases” summed together to generate total cost
 - The summed-together costing compared to “Subject Servers”
 - And the summed-together costing compared to each “Target Case” generated as a normal-mode case
 - *A case can be in normal-mode, or in hybrid-mode, not both*
 - Example ... one model to do the following ...
 - System “x” protocol servers + “p” application servers + “z” database servers COMPARED to “As-Is” and COMPARED to a total “SUN” case

zEnterprise Support

- Bigger better faster IFLs and servers
- Support for zEnterprise Unified Resource Manager
- IEDN support
- Support for PS701 blades (and future blades)
- Component pricing support
- Downstream support for RACEzOS
- Hybrid-Mode support
 - In the zEnterprise ensemble
 - Not in the zEnterprise ensemble

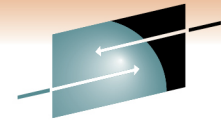
RACEzOS

- z/OS Cases (up to 3)
- Understands zIIPs and zAAPs
- Estimates distributed topology overhead
 - and the value of co-location
- Links to a RACEv “base case”
- Requires companion use of...
 - zPCR for capacity planning
 - Workload Pricer Tool for software costing

“Mainframe Executive”

- RACEv in the trade press
- “Mainframe Executive”
 - Publisher: Bob Thomas
 - Same folks who do “zJournal”
- September edition
 - Bill Carico interviews “Monte Bauman”
 - “So what is this RACE thing...?”

“Straight Talk: Right-fitting Applications into Consolidated Environments”
(Go to Page 46)



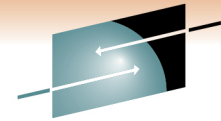
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Conclusion



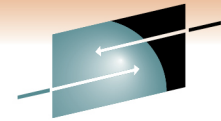
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Conclusion

- RACEv
 - Right-Fitting Applications Into Consolidated Environments
 - Server Virtualization Cost and Analysis Tool ... RACEv
 - Worldwide set of practitioners – across all IBM server brands
 - Thoughtful, consultative, even-handed analysis methodology
 - No-charge offering from IBM technical support specialists
- **And a tool-offering for YOU (if you are an IBMer)...**
- **To empower your competitive and complex solution selling efforts!**



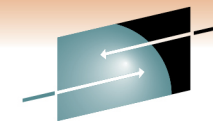
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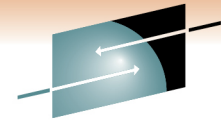
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Two-Column Slide (Type Size=28)

- Topic A (Type Size=24)
 - Subtopic 1 (Type Size=22)
 - Subtopic 2 (Type Size=22)
 - Subtopic 3 (Type Size=22)
 - Subtopic 4 (Type Size=22)
- Topic B (Type Size=24)
- Topic C (Type Size=24)
 - Subtopic 1 (Type Size=22)
 - Subtopic 2 (Type Size=22)
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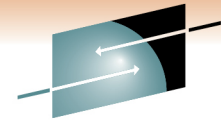


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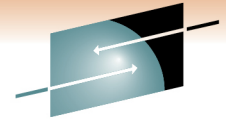
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