IBM

Server Virtualization Cost & Value Analysis Tool
RACEv
Customer Overview Guide

SHARE - Denver
August 2009

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The Mission

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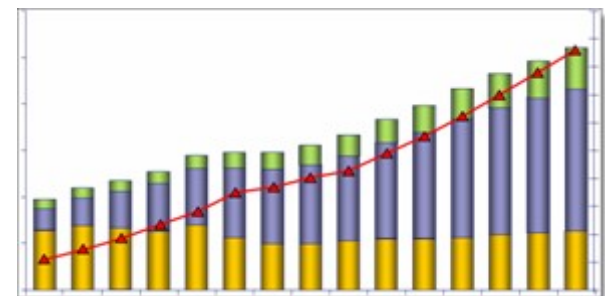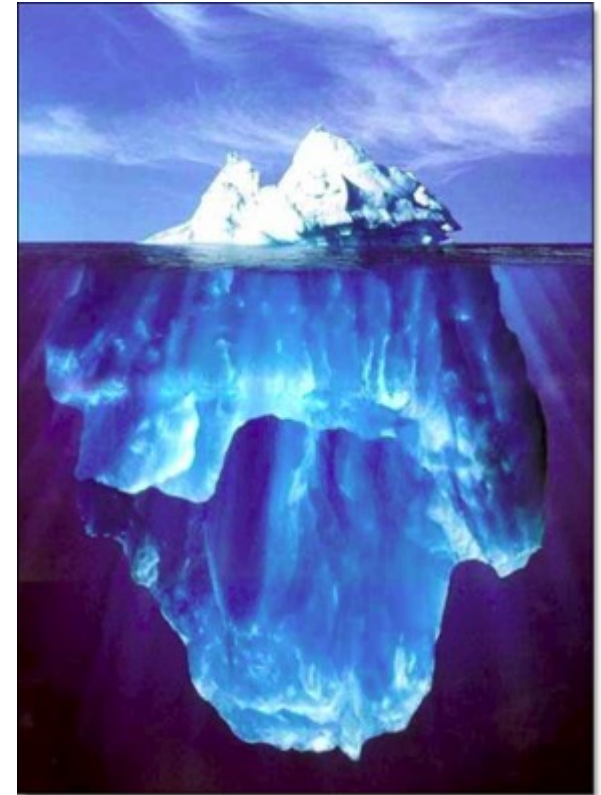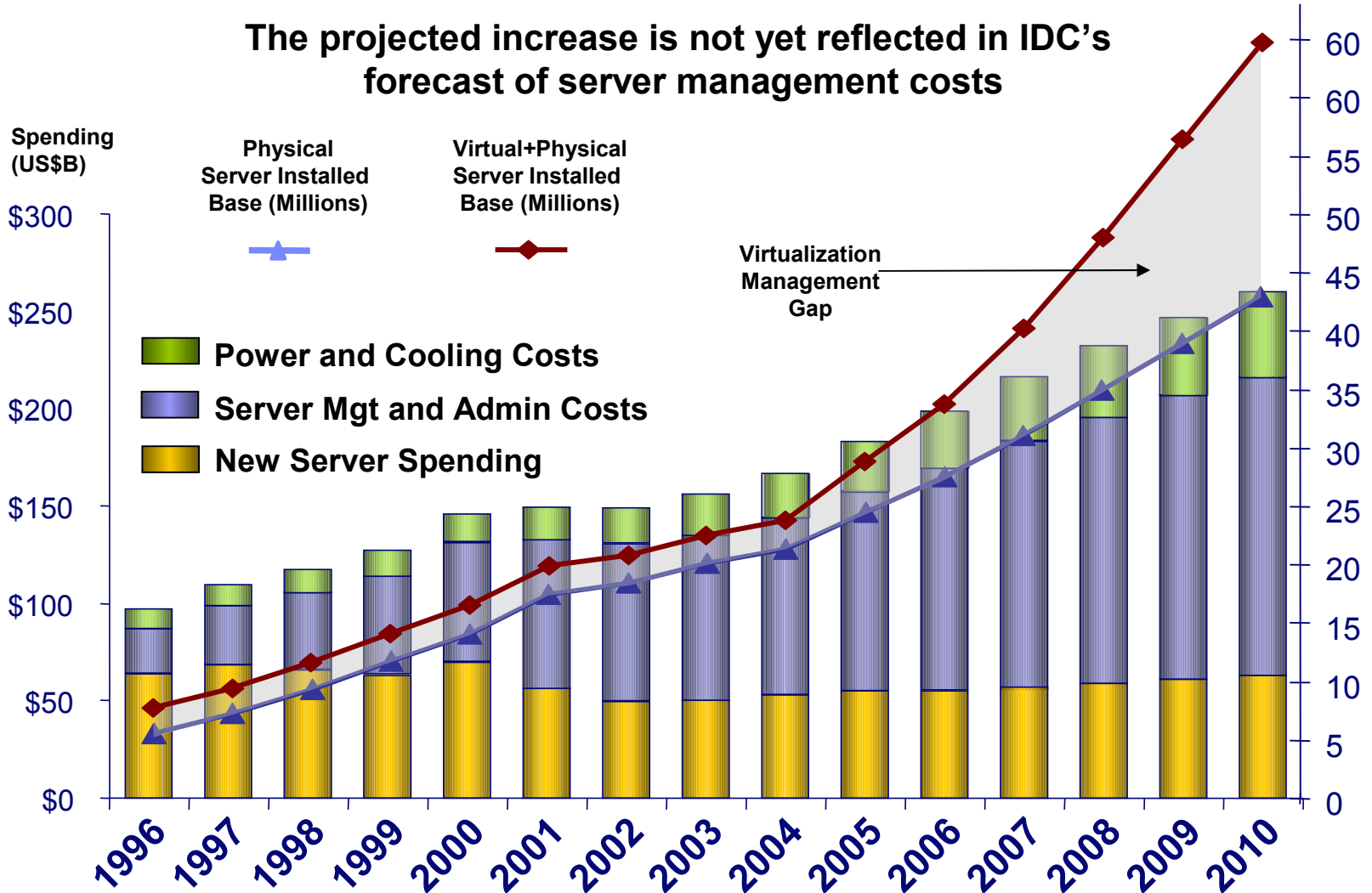
Virtualization and infrastructure mgt standards are the only hope to intercept these trends !

Source: *IDC*

IDC – Shifting Management Requirements

The projected increase is not yet reflected in IDC's forecast of server management costs

Spending (US$B)

Physical Server Installed Base (Millions)

Virtual+Physical Server Installed Base (Millions)

Virtualization Management Gap

■ Power and Cooling Costs
■ Server Mgt and Admin Costs
■ New Server Spending

Source: IDC, May 2006

The RACE Mission…

- **Choosing the Right Server…**
  - For the right reasons…
    - Functional Requirements (1st and foremost)
    - Non-Functional Requirements…
      - Cost and Value
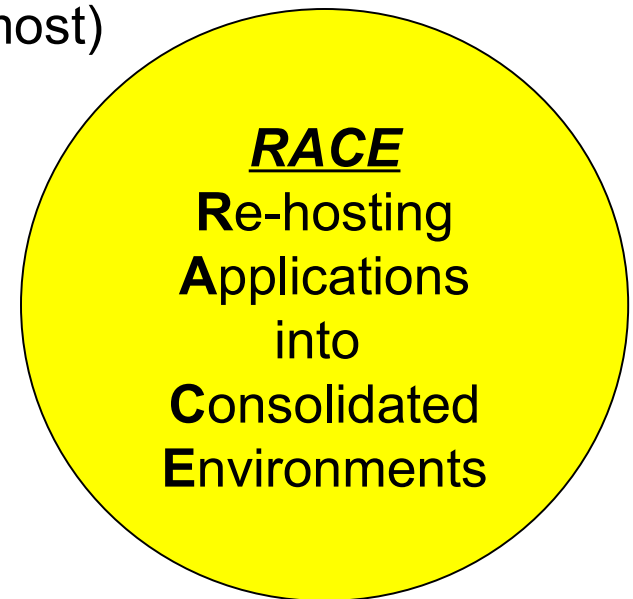   - Resilience
      - Skills
      - etc.
- **By any other name …**
  - – IT Optimization
  - – Business Justification
  - – Total Cost of Ownership / Total Cost of Computing
  - – **"Fitness for Purpose"**

RACE
Re-hosting
Applications
into
Consolidated
Environments
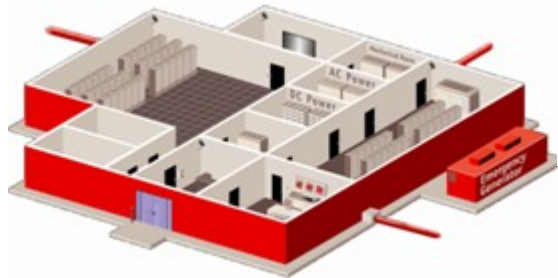
IBM

Server Choices and Cost/Value Optimization Points

Facilities
- Floorspace
- Power
- Cooling

Software
- Licenses
- Support & Subscription

redhat.
Rational.
ORACLE
Novell.
WebSphere.
DB2
Lotus
Tivoli
SAP
ca
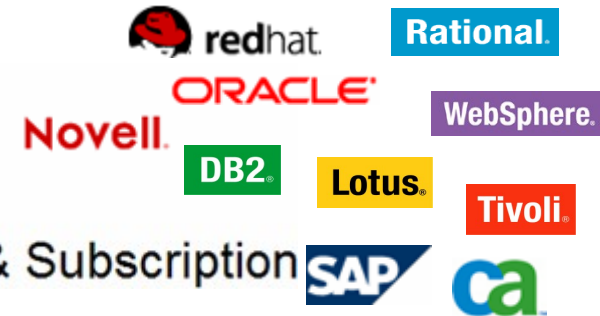
Hardware
- Servers
- Storage
- Networks
- Switches & Routers
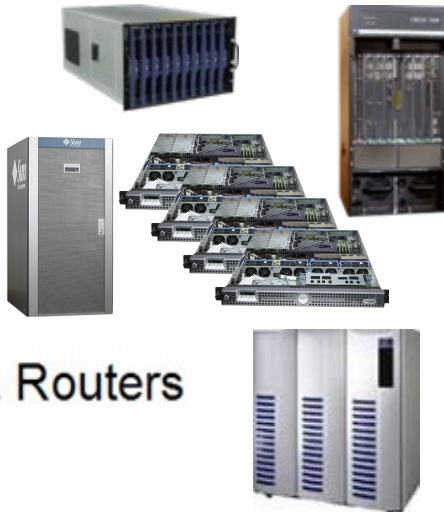
Administration
- Data Centers
- Servers
- Software
- Applications
- Data

IBM

Server Virtualization in a Nutshell (part 1)

Server

**Operating
System**

**(and middleware
and applications too)**

**Not
Much
Wrong
With This
Picture…**
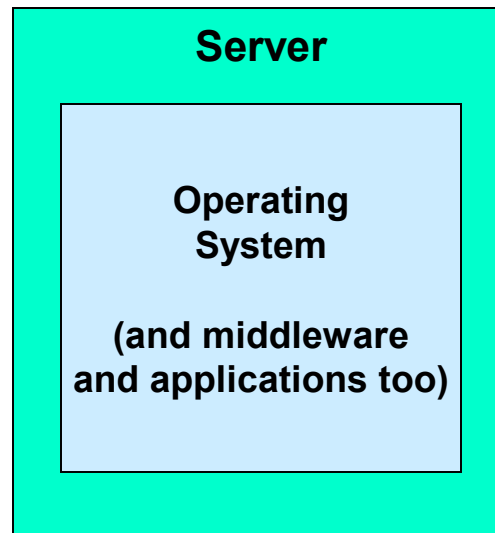
Server Virtualization in a Nutshell (part 2)

Server

Operating System

What About Now?

"Green" Vs "Gray" = "Whitespace"

IBM

Server Virtualization in a Nutshell (part 3)

And Now?!?!?!

"Whitespace" (aka inefficiency) Is killing many enterprises!

Server

Operating System

Server

Operating System

Server

Operating System

Server

Operating System
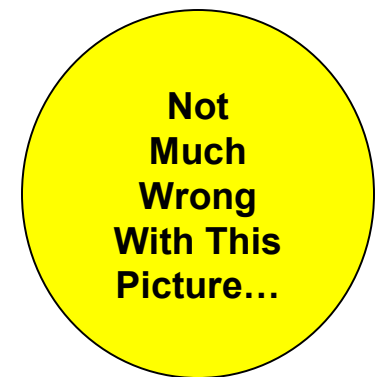
Server

Operating System

Server

Operating System

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Operating System

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Operating System

Server

Operating System

Server

Operating System

Server

Operating System

Table of Contents Link

Server Virtualization in a Nutshell (part 4)

Introducing the "Virtual Server"!

Server

Virtual Server

Operating System

Server Virtualization in a Nutshell (part 5)

Server

Virtual Server

Operating System

Virtual Server

Operating System

**Finally…
Some hope!**
(reducing whitespace / increasing efficiency)

IBM

Server Virtualization in a Nutshell (part 6)

Hardware Hypervisors…

Software Hypervisors…

Server

Virtualization Hypervisor

Virtual Server

Operating System

Virtual Server

Operating System

Provided by the server vendor…

Provided as a software product…

Provided by an open source project…
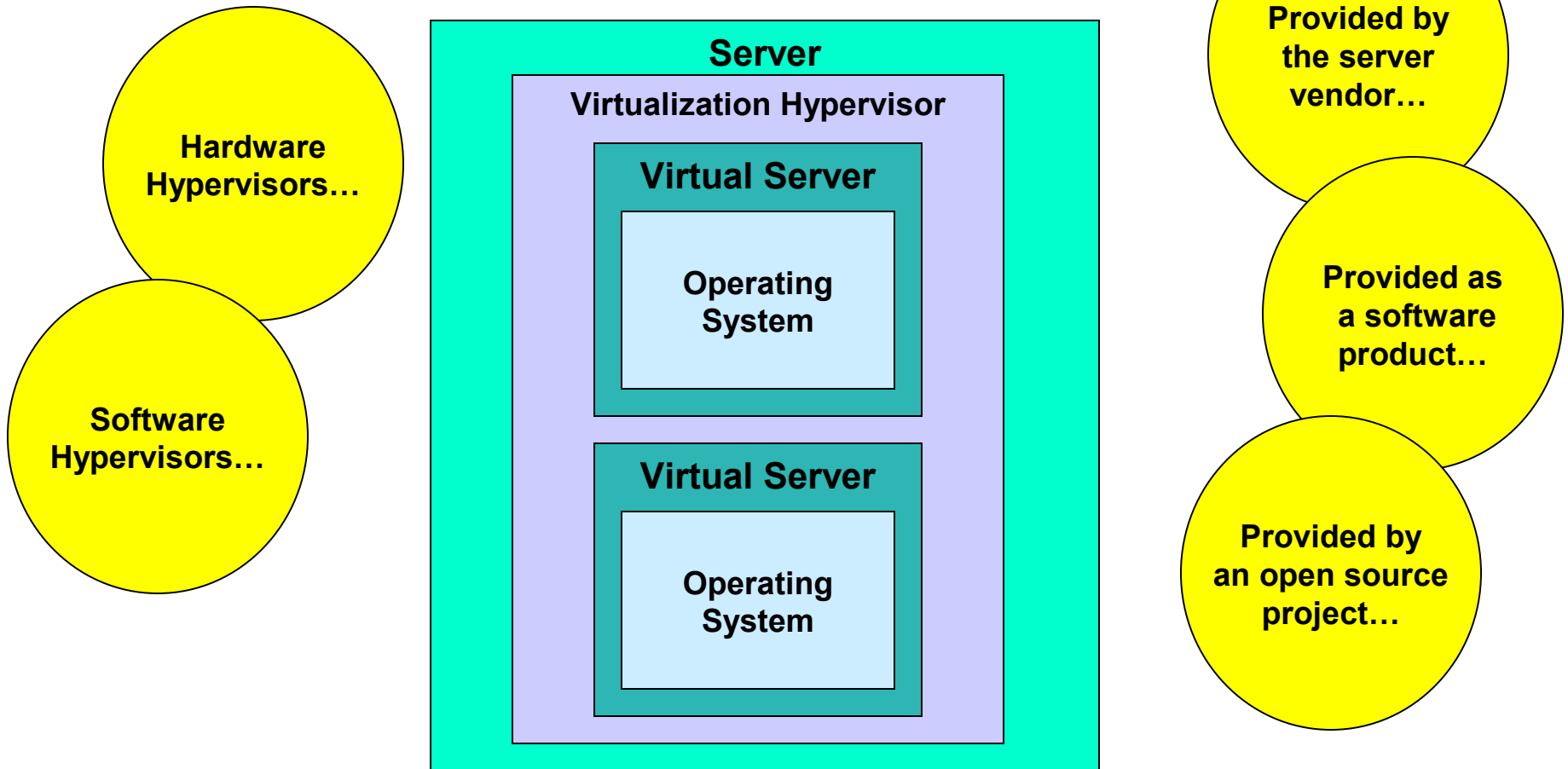
Server Virtualization in a Nutshell (part 7)

Server

Virtualization Hypervisor

Virtual Server	**Virtual Server**
Operating System	**Operating System**

Virtual Server	**Virtual Server**
Operating System	**Operating System**

Processing Perspective:

Saturation Design Point
(planned white space)

Memory Perspective:

Virtual Memory Management
(memory over-commit ratio(s))

Peak Smoothing

Hypervisor Overhead

Number and Size of Virtual Images

Server Virtualization … the Big Promise
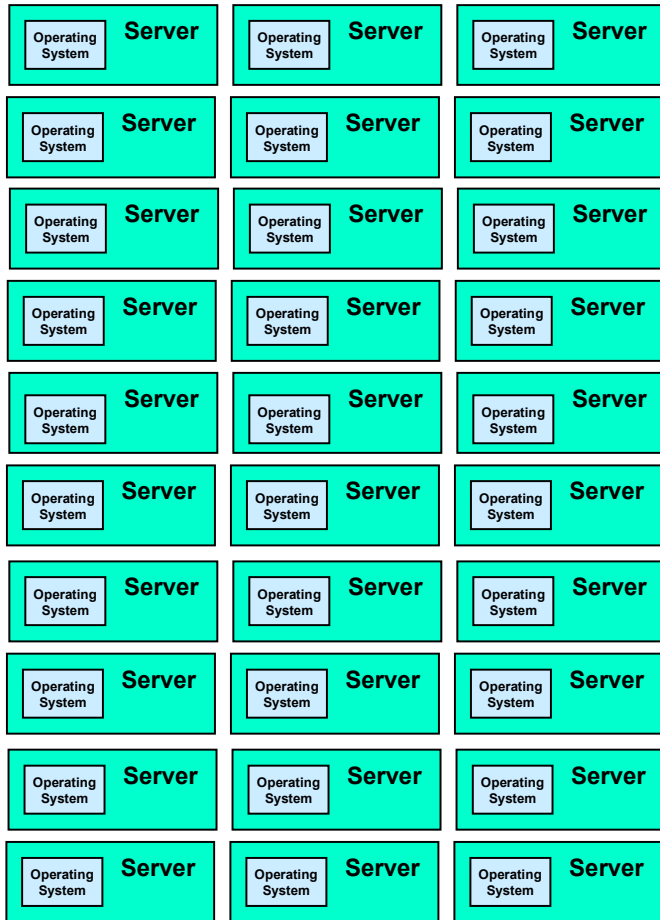
Server Consolidation via Virtualization

IBM
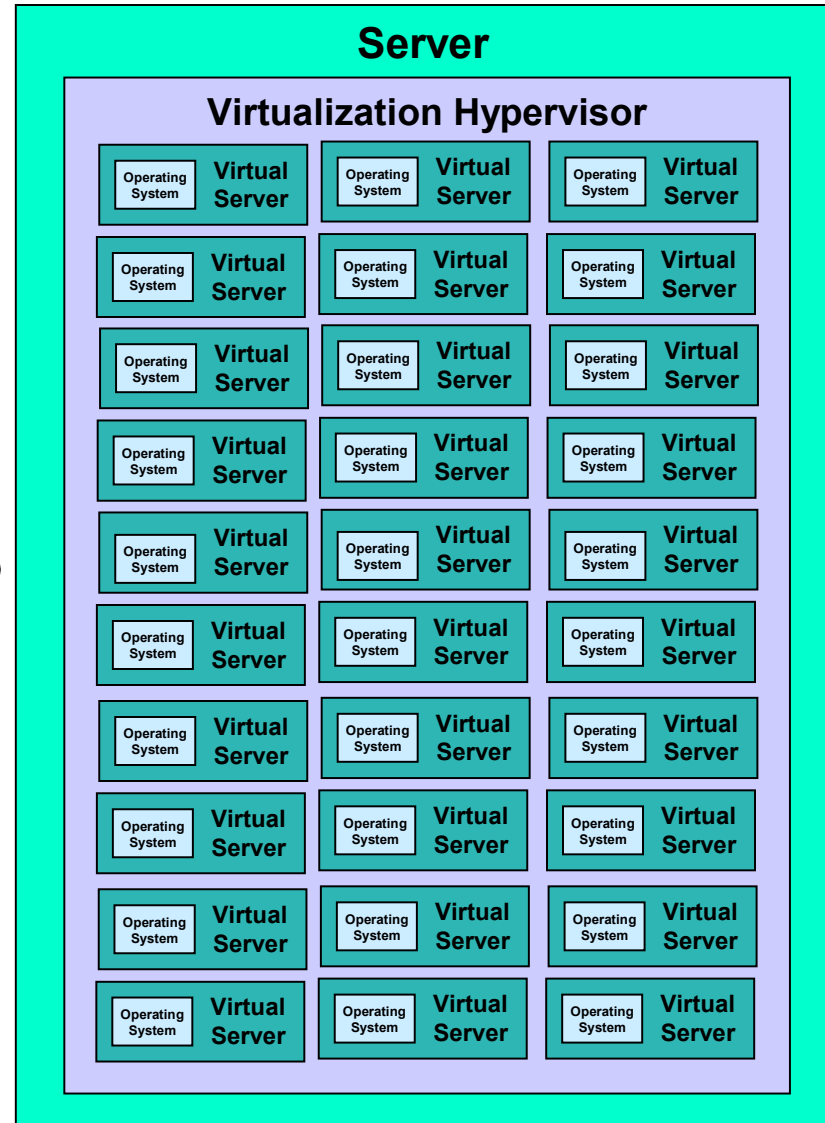
So Which Virtualization Technology is Best?

Which Server is Best?

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

It Depends… On Time Risk And Money

That's what "RACEv" is all about!
Helping to turn questions into answers

RACEv Analysis Methodology in a Nutshell
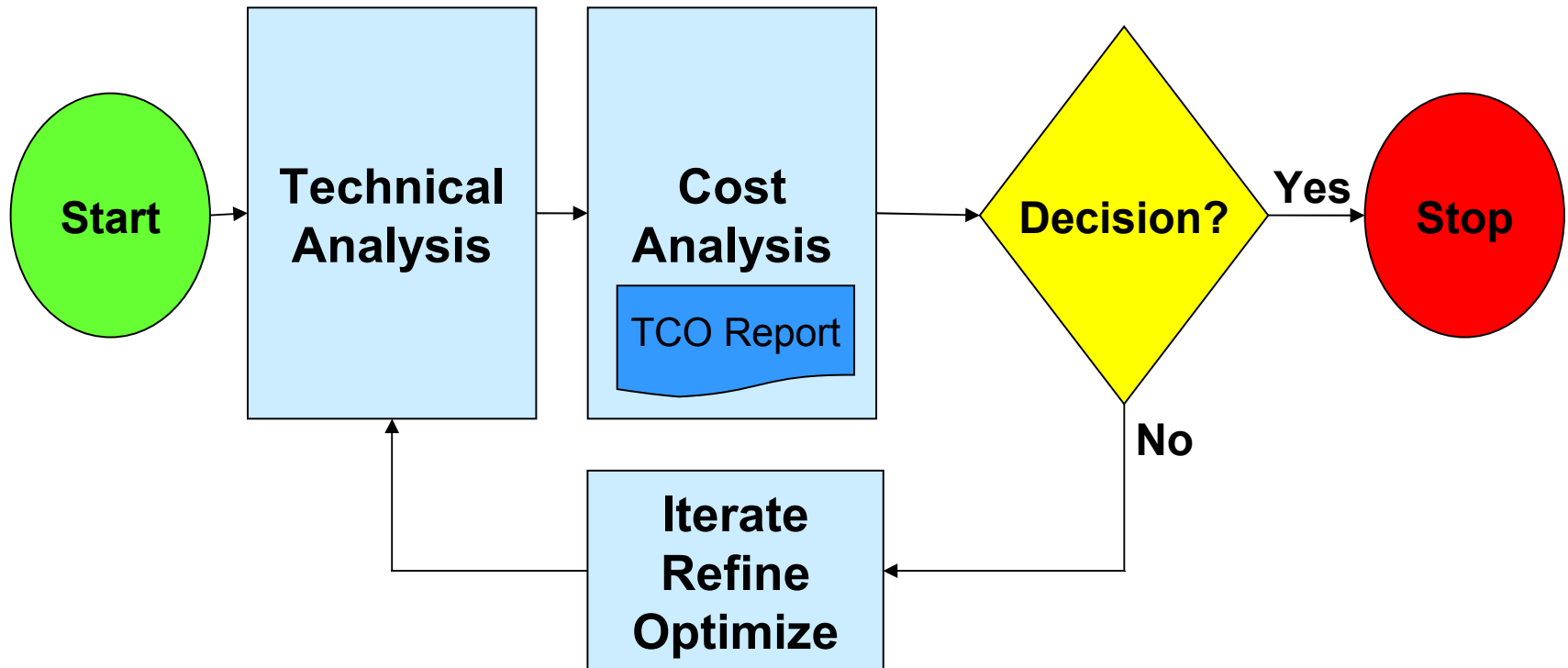
RACEv Analysis Integration Points - EXAMPLE
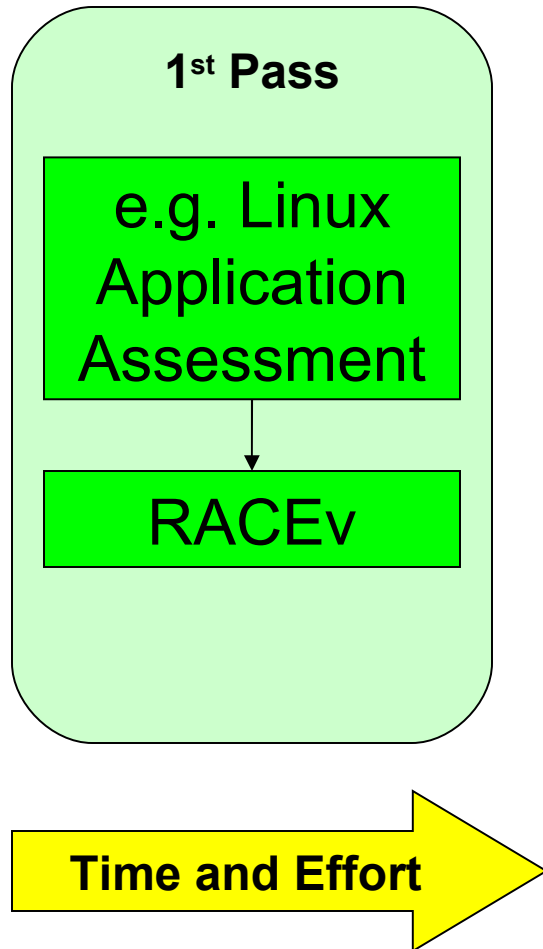
1st Pass

e.g. Linux
Application
Assessment

RACEv

Time and Effort

RACEv Analysis Integration Points - EXAMPLE

1st Pass

e.g. Linux Application Assessment

RACEv

2nd Pass

Price Calibrations

Config Calibrations

RACEv

Time and Effort

RACEv Analysis Integration Points - EXAMPLE

1st Pass

e.g. Linux Application Assessment

RACEv

2nd Pass

Price Calibrations

Config Calibrations

RACEv

3rd Pass

SURF/Scon

zVMplanner

RACEv

Time and Effort
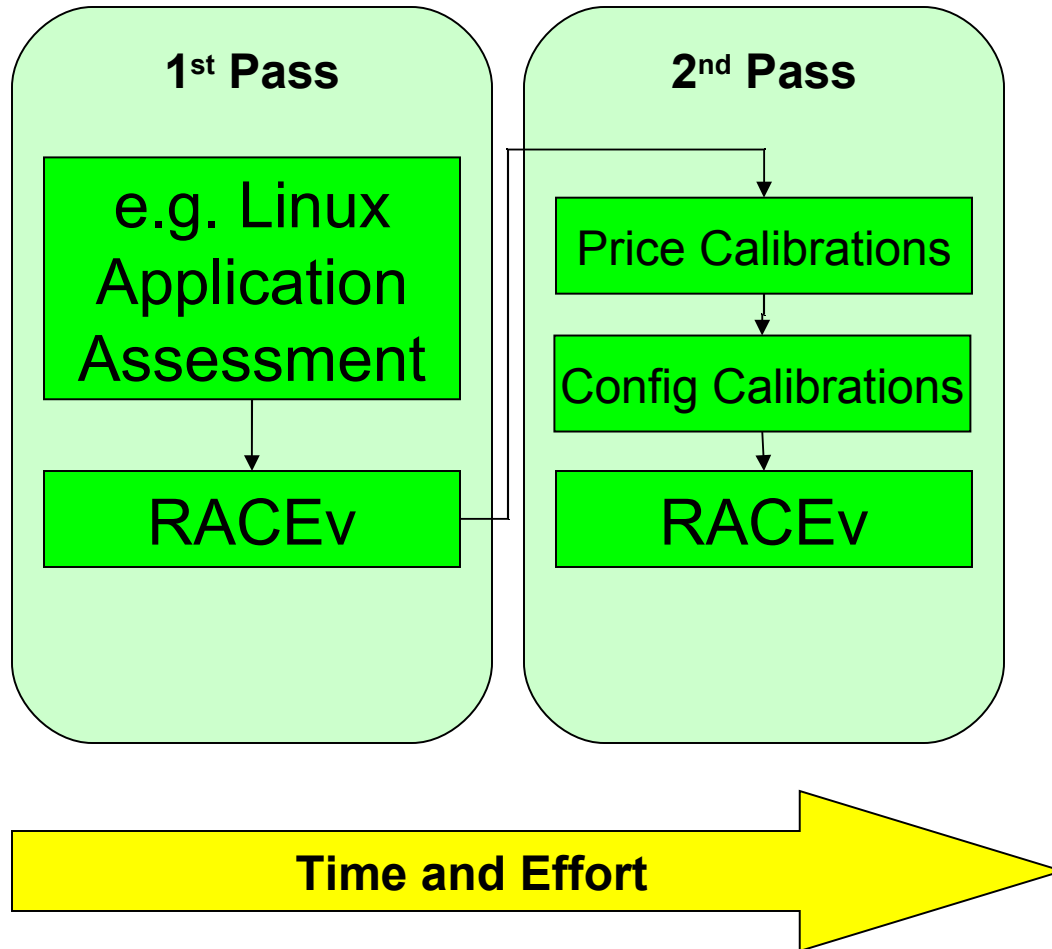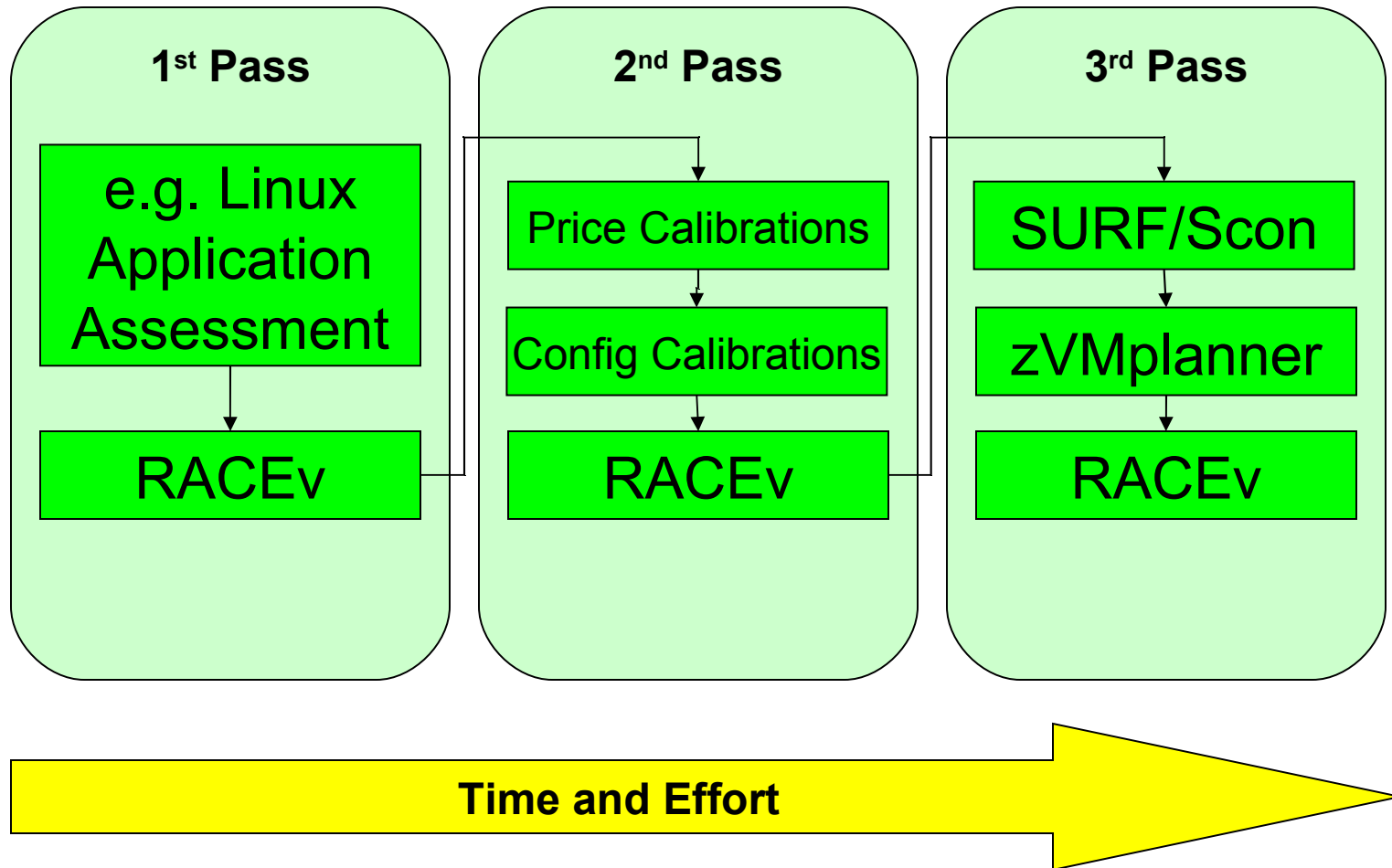
RACEv Technical Analysis Categories

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

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

1. Software Licenses
2. Software Maintenance
3. Network Bandwidth
4. Systems Administration
5. Disaster Recovery Equipment Acquisition
6. Disaster Recovery Equipment Operation
7. Cost of Downtime

* 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

   … and (as req'd) have them contact a RACEv core team consultant:

   Terry Weinberg … tlweinberg@us.ibm.com

   Bob Vik … revik@us.ibm.com

   Monte Bauman … mbauman@us.ibm.com

   Scott Lundell … solundell@us.ibm.com

End of Section

The RACEv Modeling Methodology

An Overview – the RACE Modeling Methodology

| Subject server descriptions | → | Target server descriptions by case | → | Generated target configuration | → | Generated costing information | → | Generated cost and technical comparative |

Customer configuration information

Case information

Product costing information

Subject Server Descriptions

Make/Model (chips/cores) (GHz) (capacity)

Peak Average Utilization

RAM (MBs) In Use

Disk (GBs) In Use

Purchase Price (or Book Value & Trade-In)

Annual Cost of Maintenance

Subject server descriptions

Operating System

Middleware

Data Center

Workload Type

Lifecycle Role

Application Architecture Role

Virtualization Domain

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) … 15K entries in table, all major vendors represented

Customer Configuration Information

Data Centers	DC1	DC2	DC3	DC4	DC5	...	DC10	

Lifecycle Roles	Team Test →	System Test →	User Test →	QA →	Prod →	Backup →	DR

Application Architecture Roles	HTTP Srvr →	Presentation Server →	Application Server →	Database Server

Virtualization Domains	Domain 1	Domain 2	· · · · · · · ·	Domain 6

Workload Types	OLTP	Java	Static HTTP	Mixed High	· · ·	Database

Subject server descriptions

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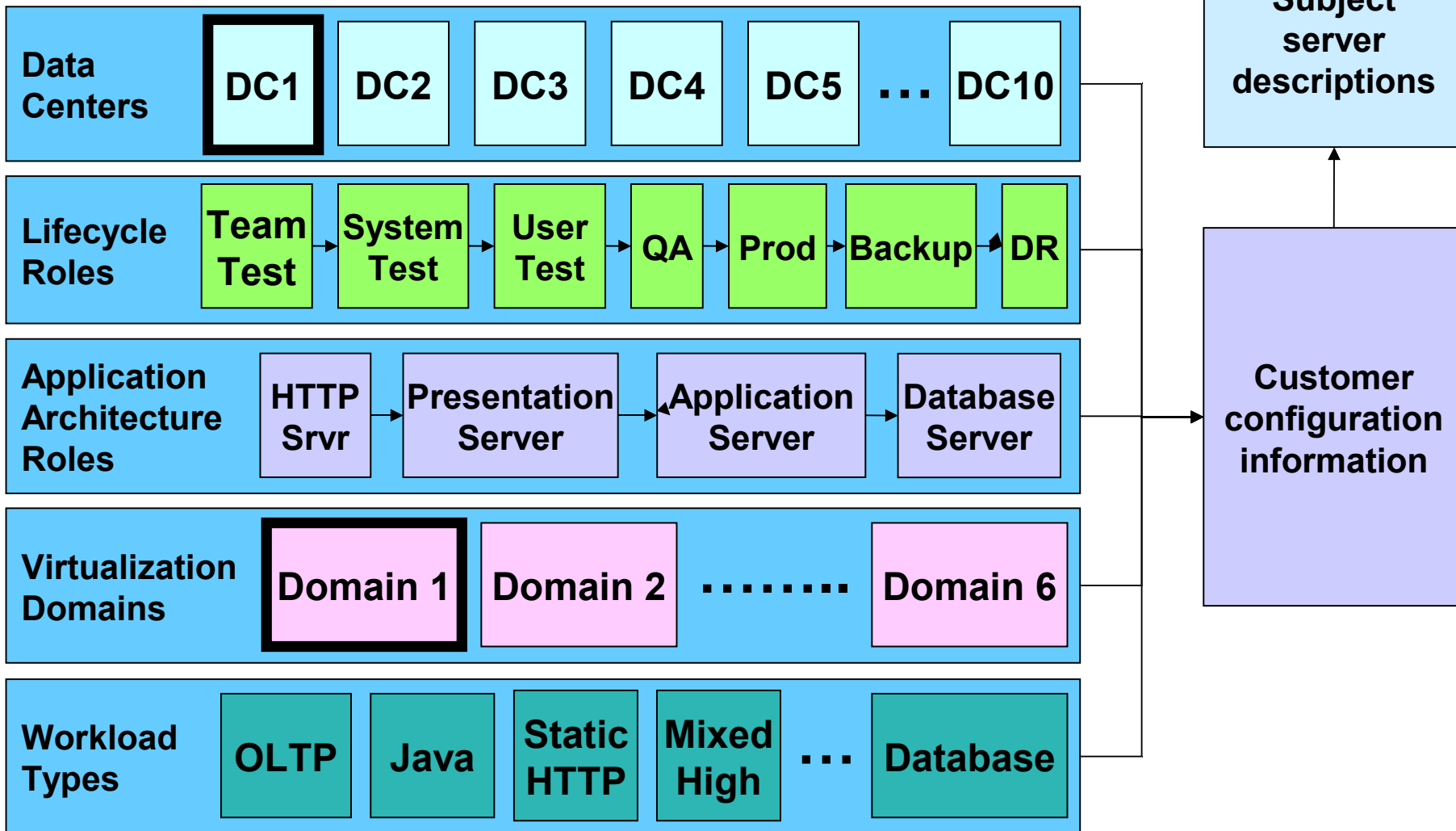
All above configuration information is customizable via simple table edits in the tool.

Subject Server to Target Server Mapping
"Virtualization Domains"

Subject03
"Domain1"
DB2

Subject01
"Domain1"
WAS

Subject02
"Domain1"
WMQ

Subject04
"Domain1"
WAS,WMQ

Subject11
"Domain2"
IHS

Subject14
"Domain2"
WAS

Subject15
"Domain2"
WAS

Subject13
"Domain2"
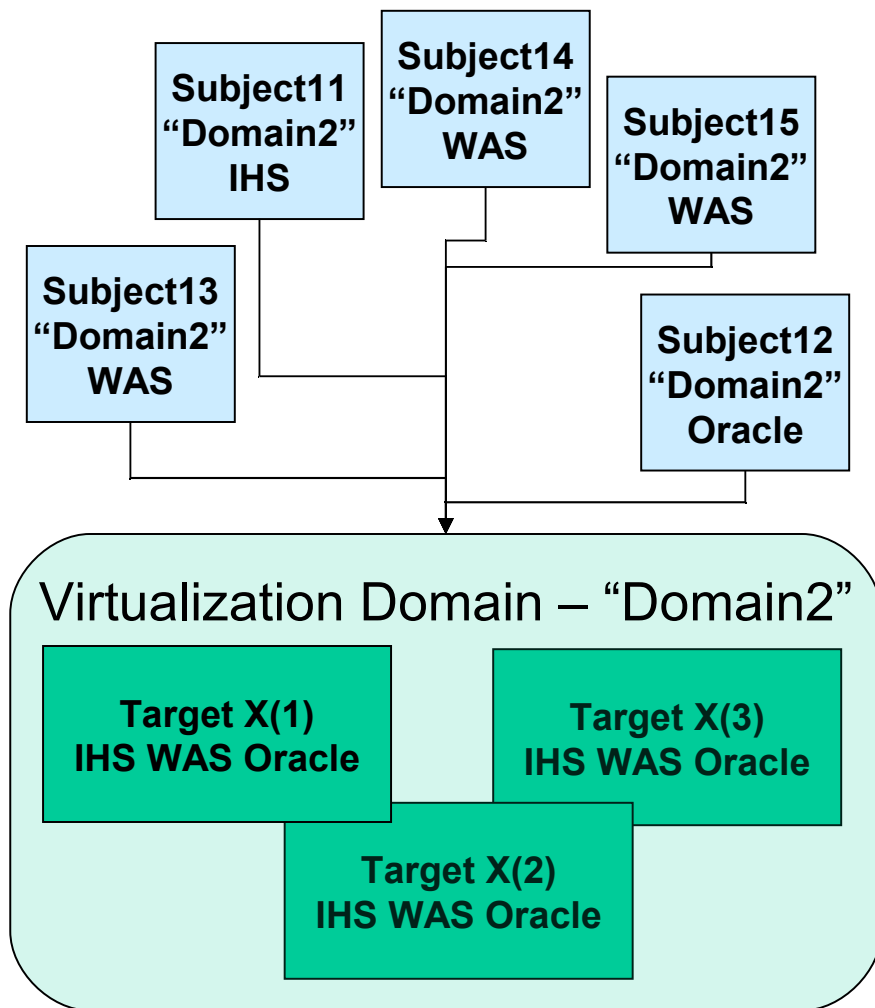WAS

Subject12
"Domain2"
Oracle

Virtualization Domain – "Domain1"

Target Y(1)
WAS WMQ DB2

Target Y(2)
WAS WMQ DB2

Virtualization Domain – "Domain2"

Target X(1)
IHS WAS Oracle

Target X(3)
IHS WAS Oracle

Target X(2)
IHS WAS Oracle

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

Target Server Descriptions

Make/Model (chips/cores) (GHz) (capacity)	Purchase Price	Price of Maintenance	Hypervisor

Capacity Planning Saturation Design Point			Hypervisor Overhead

Target server descriptions by case

RAM (MBs) installed			Peak Smoothing

Data Center	Operating System	Middleware	Hypervisor Memory Overcommit Ratios

Target Server Capacity Planning

Subject03
"Domain1"
DB2

Subject01
"Domain1"
WAS

Subject04
"Domain1"
WAS,WMQ

Subject02
"Domain1"
WMQ

Virtualization Domain – "Domain1"

Target Y(1)
WAS WMQ DB2

Target Y(2)
WAS WMQ DB2

Hypervisor Overhead

Sum
of
Subjects
Utilization
Divided
By "N"

Saturation Design Point

Target Y(1)
Server Capacity

Peak Smoothing

Hypervisor Overhead

Sum
of
Subjects
Utilization
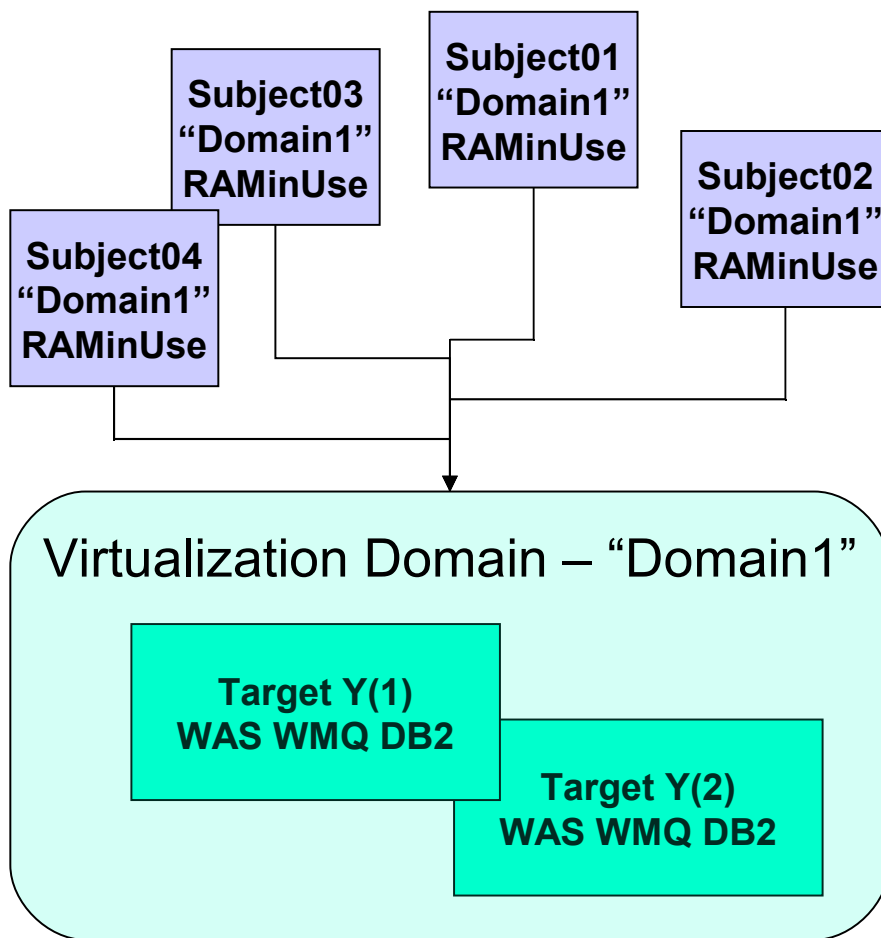Divided
By "N"

Saturation Design Point

Target Y(1)
Server Capacity

Peak Smoothing

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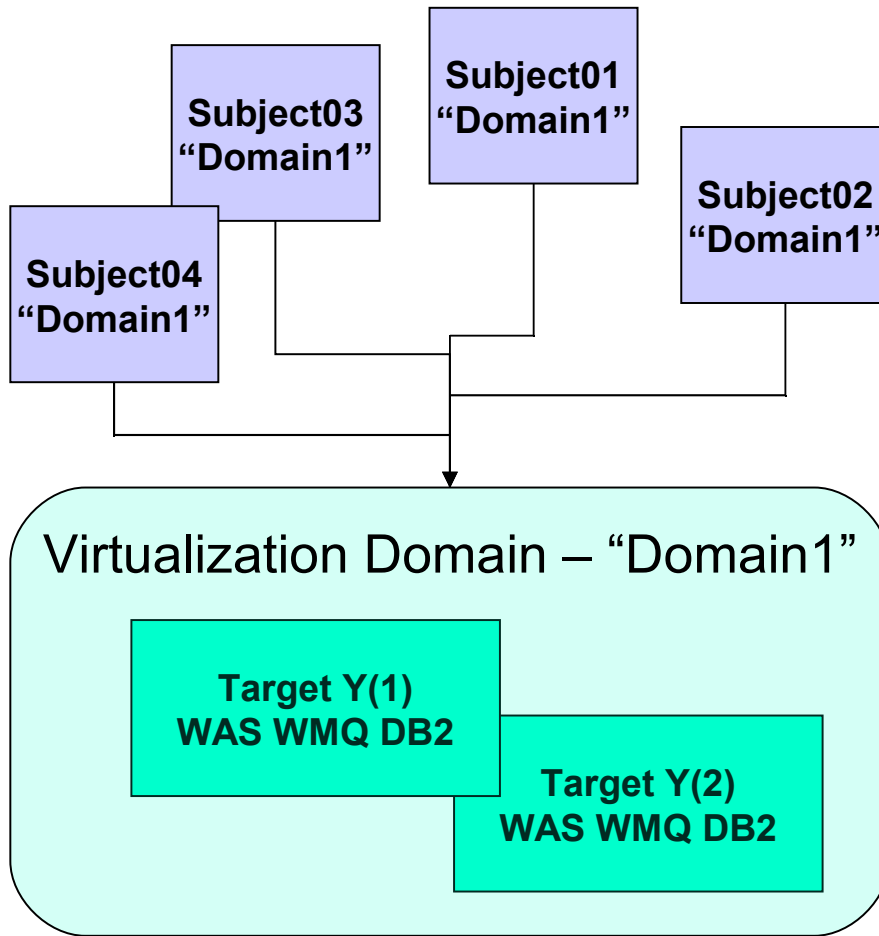
Target Server Memory Capacity Planning

Subject03 "Domain1" RAMinUse

Subject01 "Domain1" RAMinUse

Subject02 "Domain1" RAMinUse

Subject04 "Domain1" RAMinUse

Sum of Subjects Memory in Use Divided by Hypervisor Overcommit Ratios Divided by "N"

Target Y(1) Installed RAM

Virtualization Domain – "Domain1"

Target Y(1) WAS WMQ DB2

Target Y(2) WAS WMQ DB2

Sum of Subjects Memory in Use Divided by Hypervisor Overcommit Ratios Divided by "N"

Target Y(2) Installed RAM

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

Target Server Hypervisor Capacity Planning

Subject03
"Domain1"

Subject01
"Domain1"

Subject02
"Domain1"

Subject04
"Domain1"

Virtualization Domain – "Domain1"

Target Y(1)
WAS WMQ DB2

Target Y(2)
WAS WMQ DB2

Max virtual machines per hypervisor

Max virtual machines per core
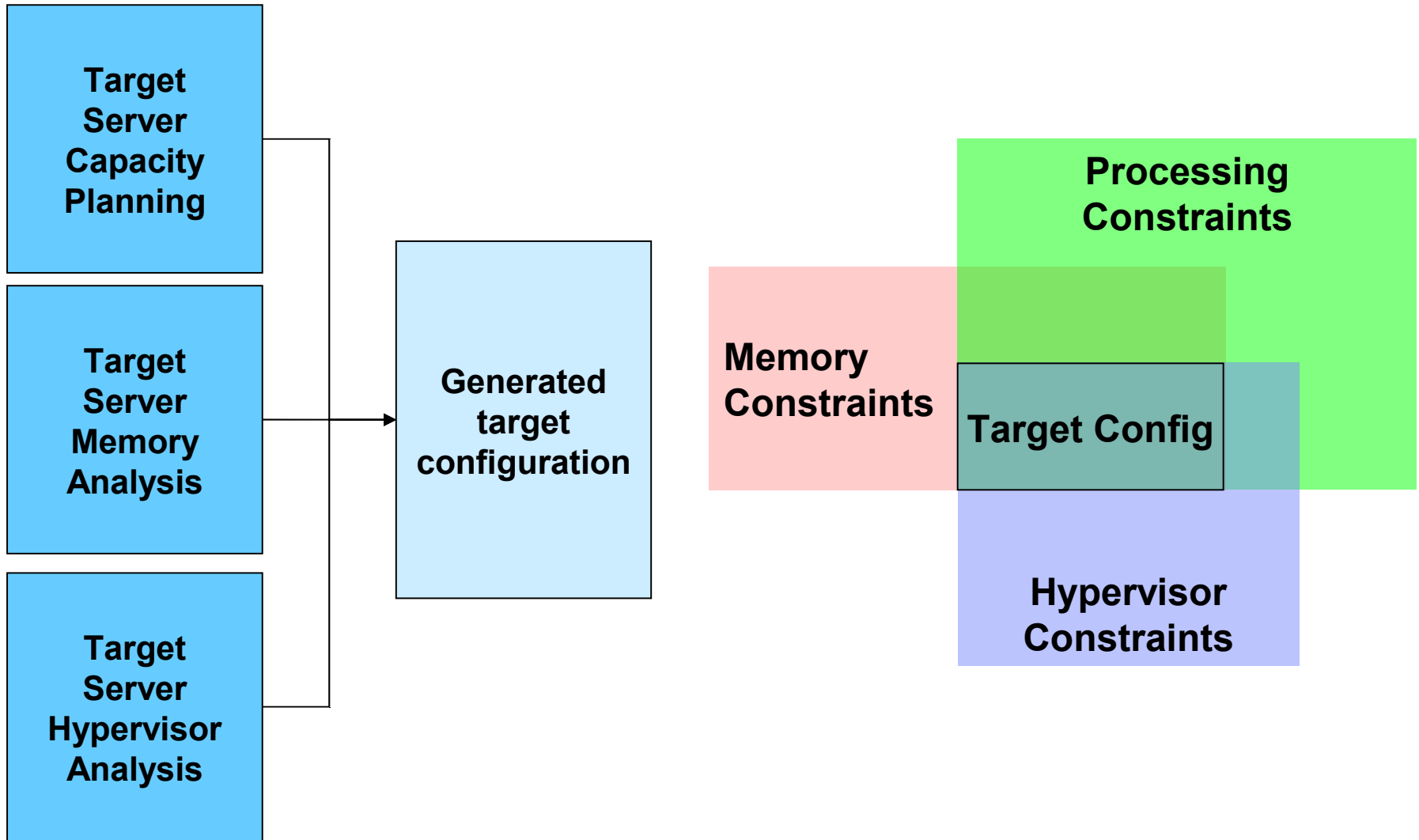
Max memory per hypervisor

Max cores per hypervisor

Target Y(1)
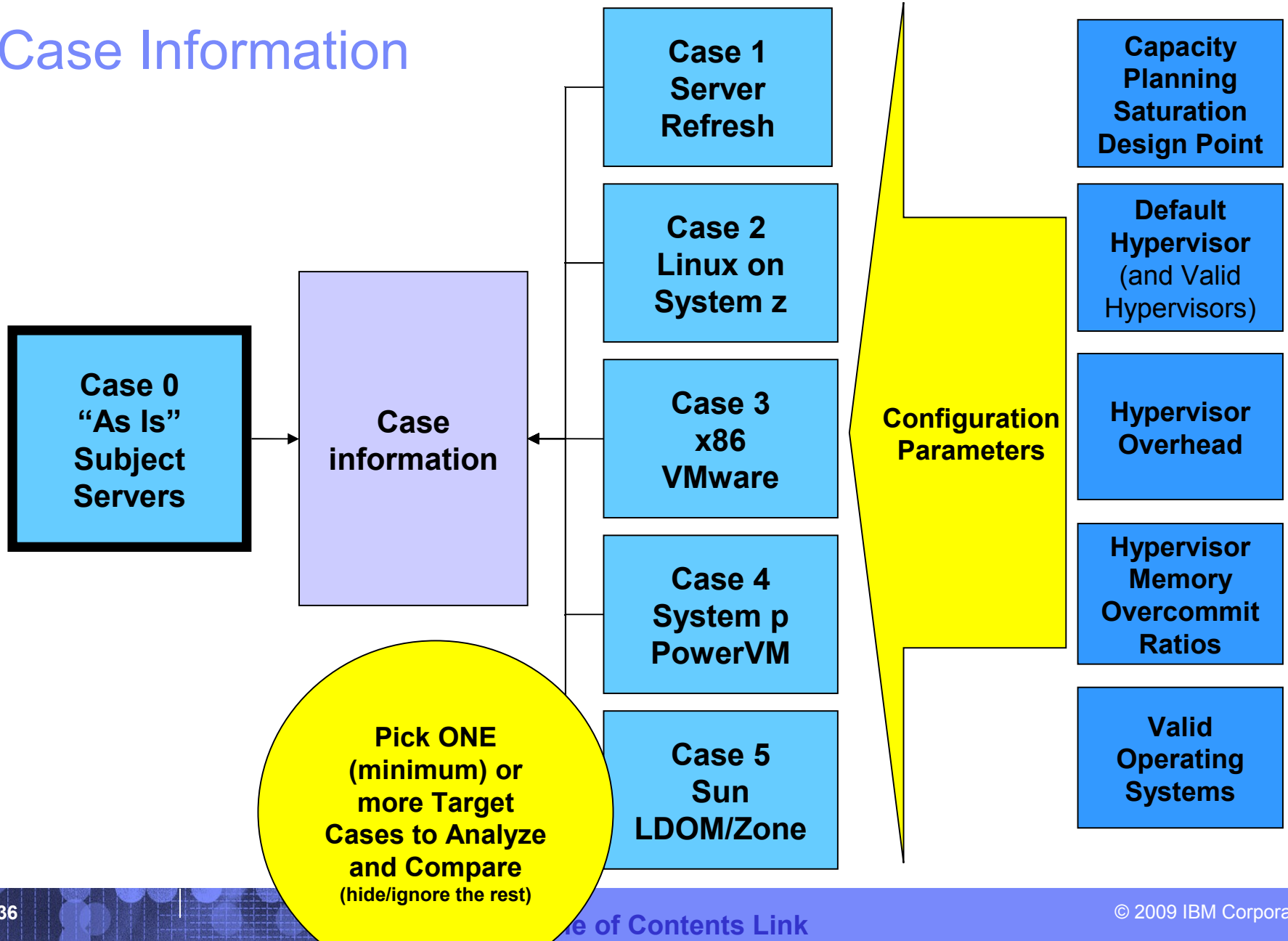Hypervisor Characteristics

Max virtual machines per hypervisor

Max virtual machines per core

Max memory per hypervisor

Max cores per hypervisor

Target Y(2)
Hypervisor Characteristics

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

Generated Target Configuration

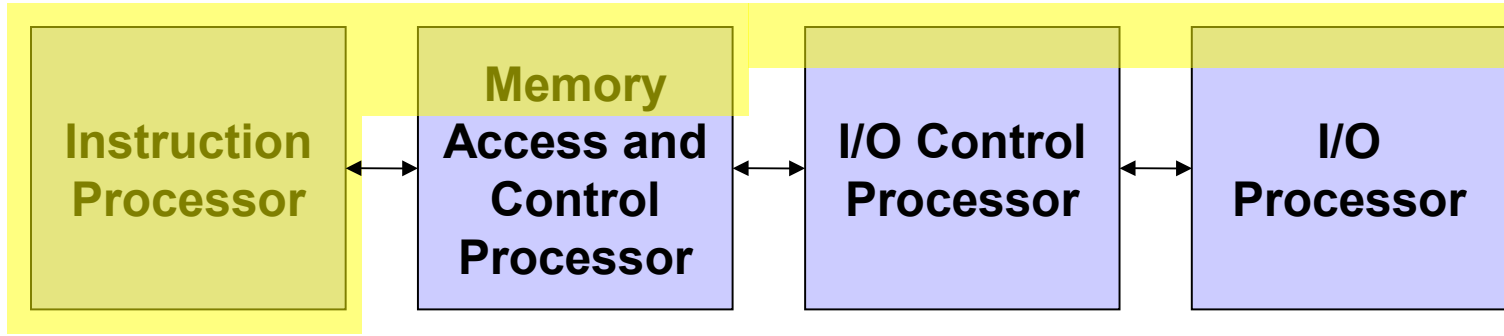**Target Server Capacity Planning**

Target Server Memory Analysis

Target Server Hypervisor Analysis

Generated target configuration

Processing Constraints

Memory Constraints

Target Config

Hypervisor Constraints

Case Information

Case 0 "As Is" Subject Servers

Case information

Case 1 Server Refresh

Case 2 Linux on System z

Case 3 x86 VMware

Case 4 System p PowerVM

Case 5 Sun LDOM/Zone

Pick ONE (minimum) or more Target Cases to Analyze and Compare (hide/ignore the rest)

Configuration Parameters

Capacity Planning Saturation Design Point

Default Hypervisor (and Valid Hypervisors)

Hypervisor Overhead

Hypervisor Memory Overcommit Ratios

Valid Operating Systems

e of Contents Link
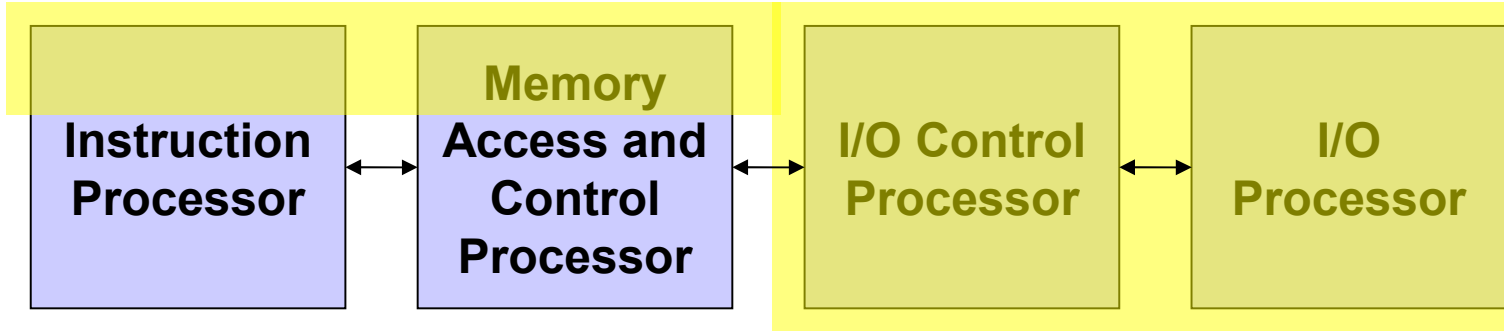
System z Cross-Server Capacity Mapping

- **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!
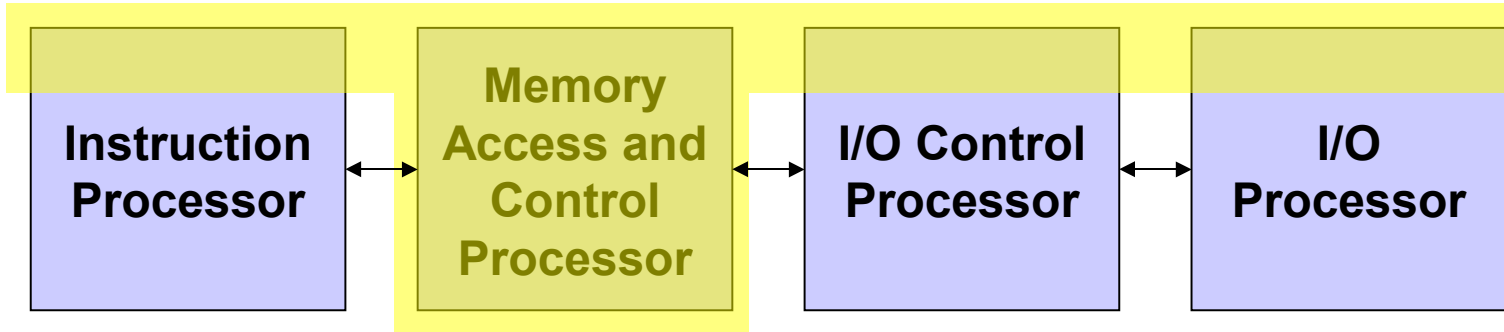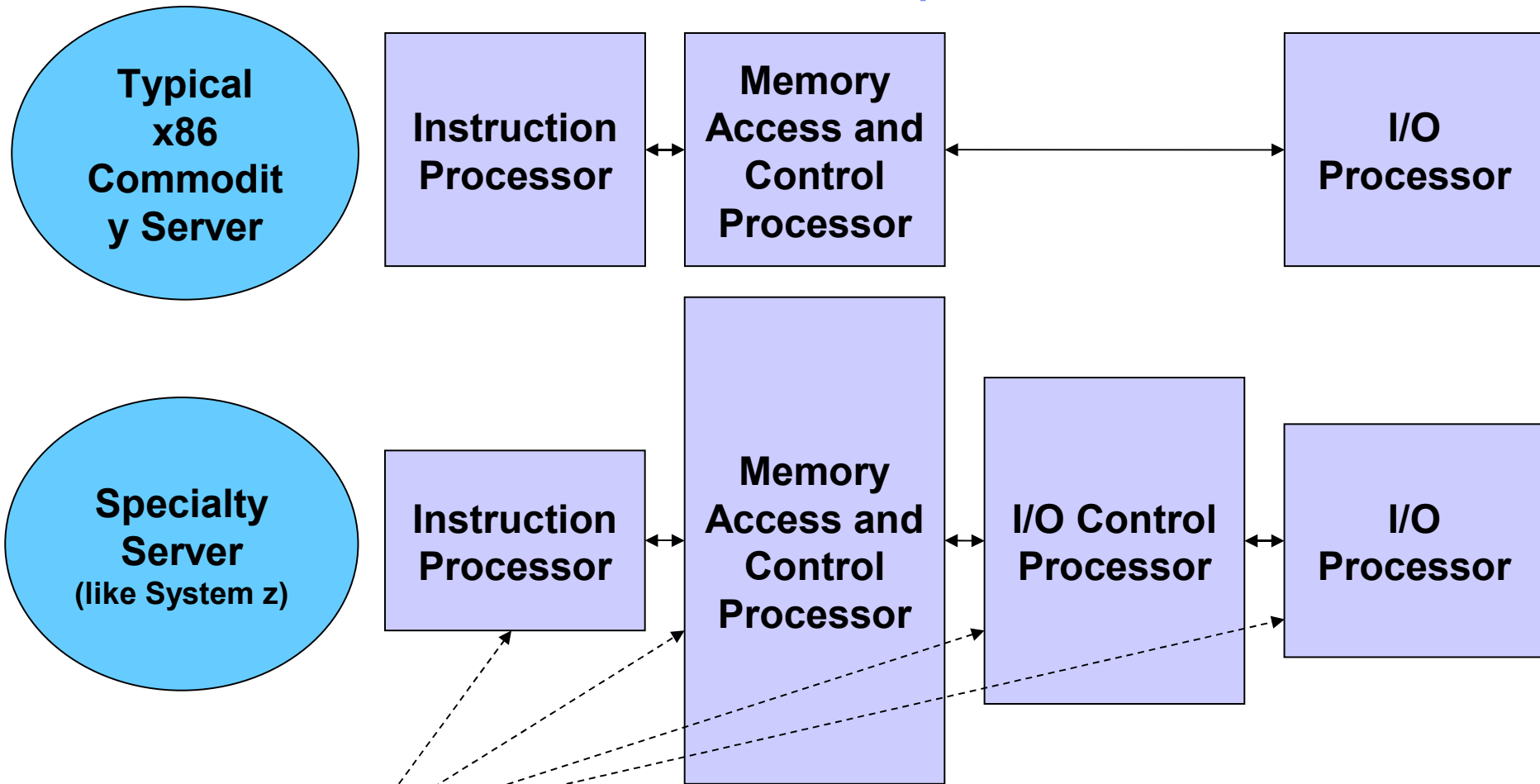
IBM

Workloads – "Execution Time Content"

CPU-Bound Workload	**Instruction Processor** ⟷	**Memory Access and Control Processor** ⟷	**I/O Control Processor** ⟷ **I/O Processor**
I/O-Bound Workload	**Instruction Processor** ⟷	**Memory Access and Control Processor** ⟷	**I/O Control Processor** ⟷ **I/O Processor**
Bus-Bound Workload	**Instruction Processor** ⟷	**Memory Access and Control Processor** ⟷	**I/O Control Processor** ⟷ **I/O Processor**

Processors – "Execution Time Optimizations"

Typical x86 Commodity Server

| Instruction Processor | ↔ | Memory Access and Control Processor | ↔ | I/O Processor |

Specialty Server (like System z)

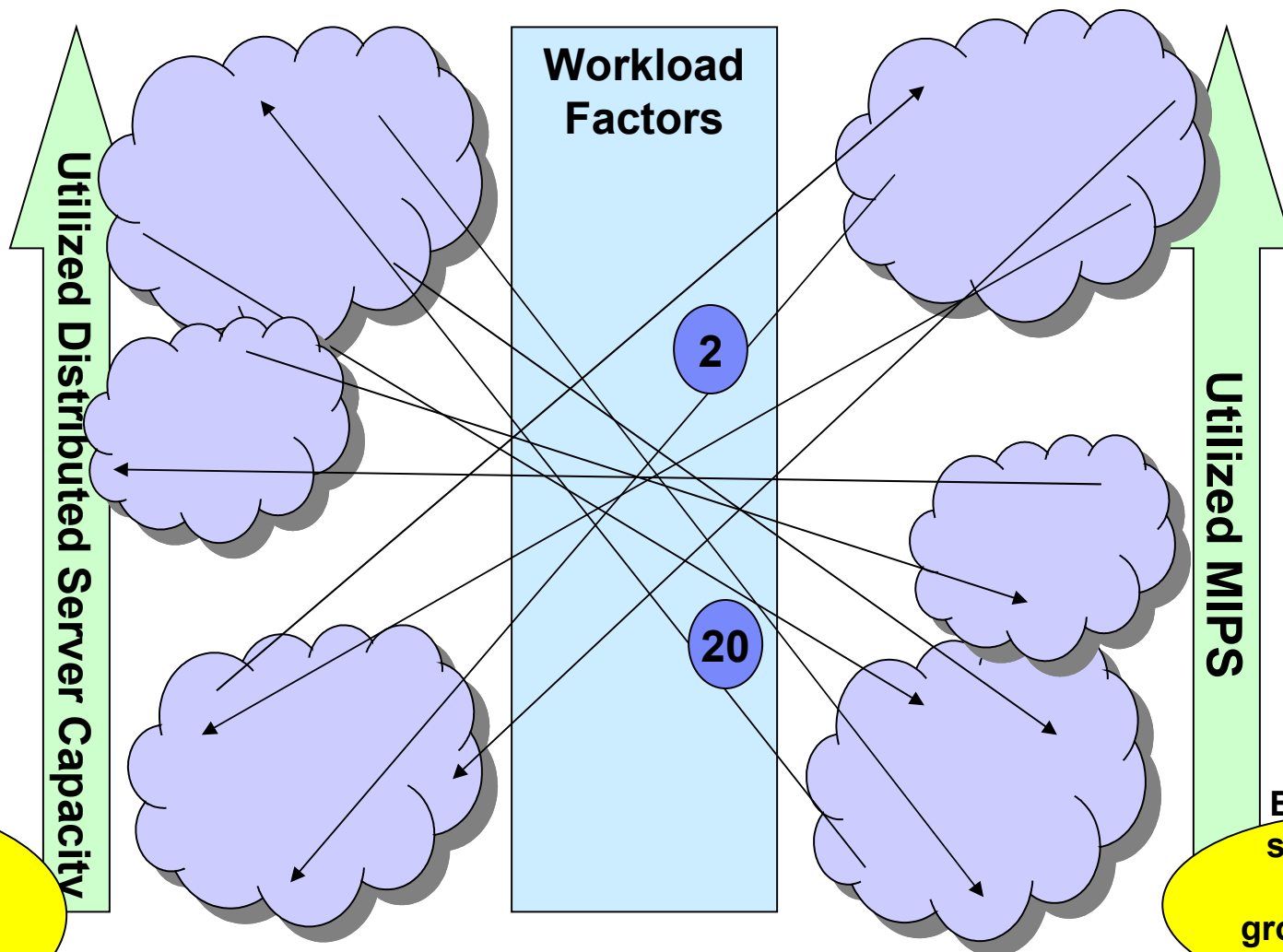| Instruction Processor | ↔ | Memory Access and Control Processor | ↔ | I/O Control Processor | ↔ | I/O Processor |

$$Execution\ Time = \frac{Seconds}{Cycle} \times \frac{Cycles}{Instruction} \times Instructions$$

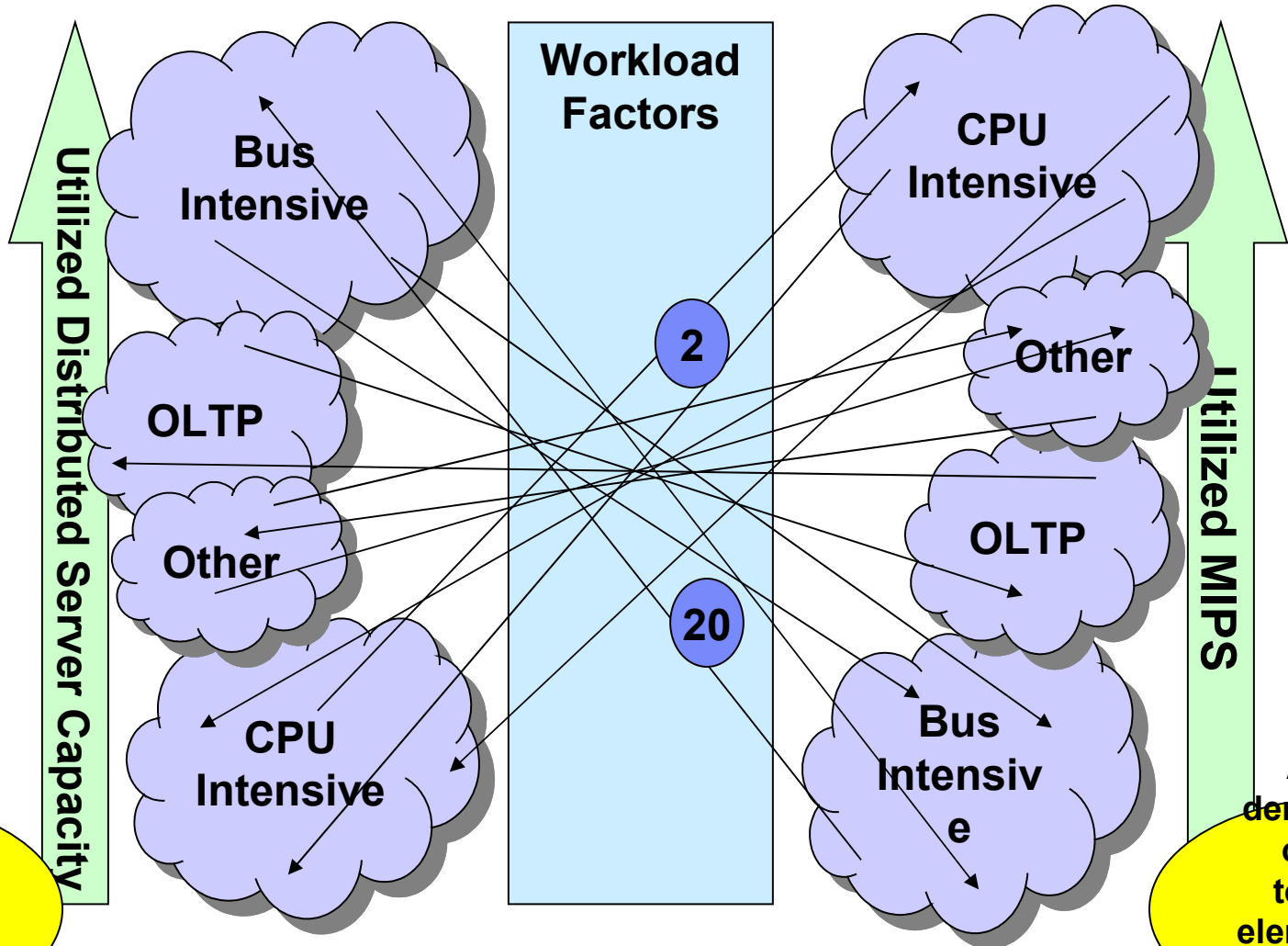# Workload Factors ... Derived From Many Observations

Workload Factors

Utilized Distributed Server Capacity

Utilized MIPS

2

20

Each arrow signifies a workload movement… and before/after measurements

Each cloud signifies an observed grouping… i.e. a workload type

Workload Factors ... Applying Technical Understanding

Workload Factors

Utilized Distributed Server Capacity

Utilized MIPS

Bus Intensive

OLTP

Other

CPU Intensive

CPU Intensive

Other

OLTP

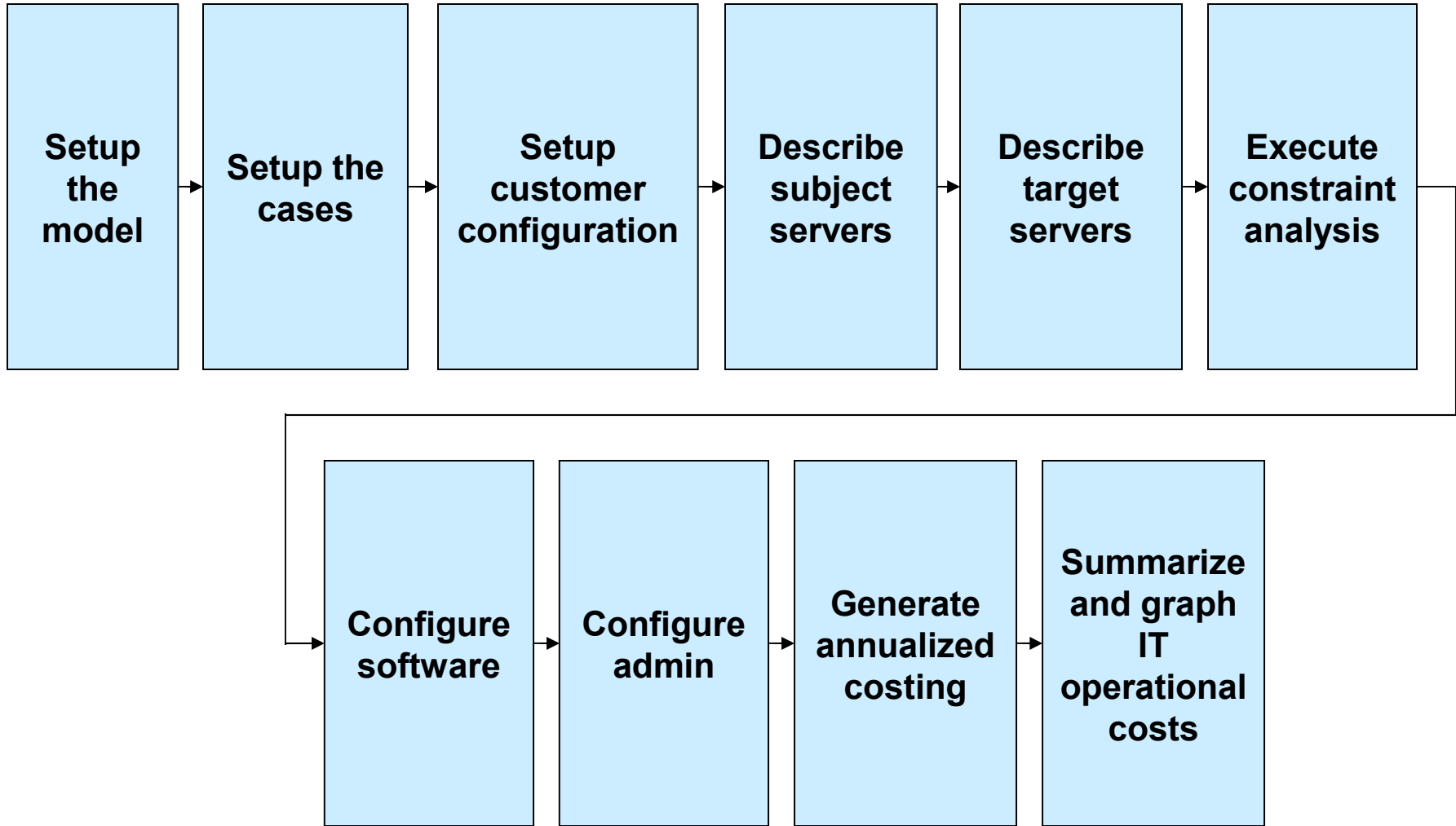**Bus Intensive**

2

20

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

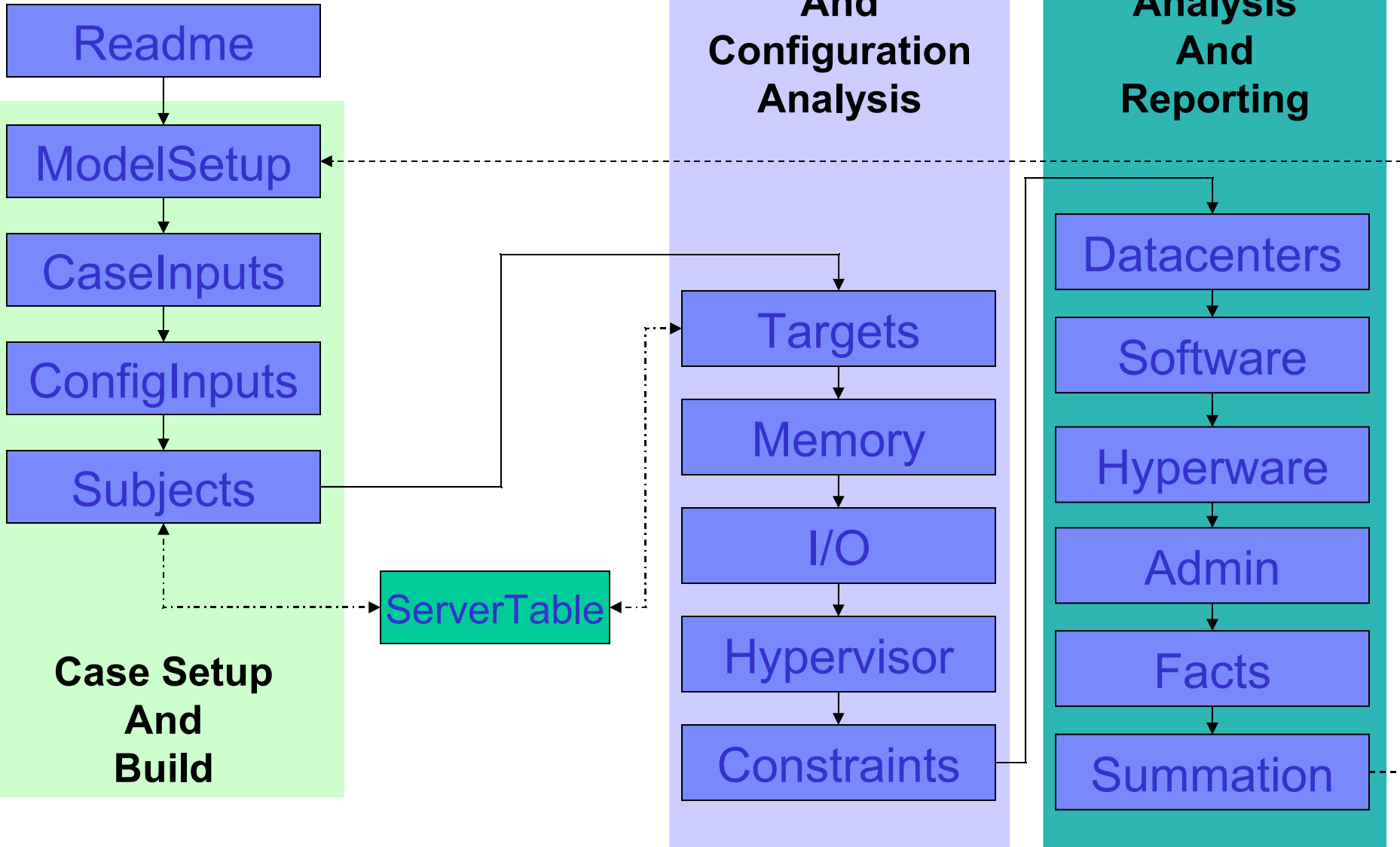And we derived a list of the 6 technical elements that seemed best to drive the mapping

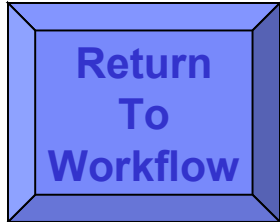# End of Section

RACEv Run-Through

The RACEv Model in a Nutshell

| Setup the model | → | Setup the cases | → | Setup customer configuration | → | Describe subject servers | → | Describe target servers | → | Execute constraint analysis |

| Configure software | → | Configure admin | → | Generate annualized costing | → | Summarize and graph IT operational costs |

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RACEv Workflow

Constraint And Configuration Analysis

Cost Analysis And Reporting

Readme

ModelSetup

CaseInputs

ConfigInputs

Subjects

ServerTable

Case Setup And Build

Targets

Memory

I/O

Hypervisor

Constraints

Datacenters

Software

Hyperware

Admin

Facts

Summation

IBM

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

R A C E v - S e r v e r   V i r t u a l i z a t i o n   C o s t   &   V a l u e   A n a l y s i s   T o o l

Security and Compliance Information

Security Classification: **IBM Internal Use Only**
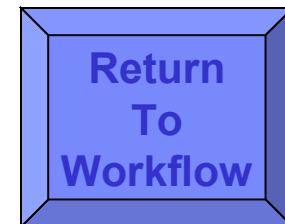Licensed Materials - Property of IBM
© Copyright IBM Corp. 2009

Release Information

| Version.Release: | 1.4.1 | Release Date: | 27 July 2009 |

Model Filename: C:\DATA\ES\Modeling\RACEv\[RACEv_20090727_V141.xls]Readme

Model Setup

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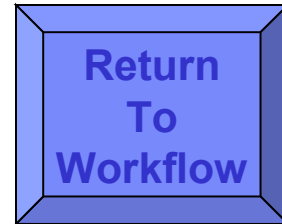- Pushbuttons (next page)

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 …

IBM

Model Setup - Pushbuttons

Return To Workflow

- 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

Return To Workflow
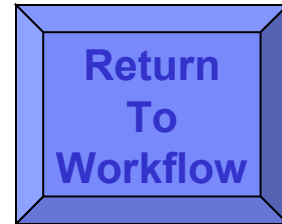
## Key Case Inputs Panel

Case Naming and Hypervisor Setup Table

	Case 0	Case 1	Case 2	Case 3	Case 4
Case Identification	Case 0	Case 1	Case 2	Case 3	Case 4
Default Case Hypervisor	No Hypervisor	No Hypervisor	z/VM-5.3 + PR/SM	VMware ESX 2.0	p5 POWER Hypervisor
Manufacturer/Vendor or Other Descriptor	Subject	Server	IBM	-	IBM
Server/Model or Other Descriptor	Servers	Refresh	System z	-	System p
Case Long Description	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)

IBM

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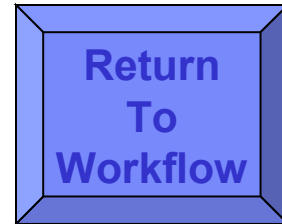
- Setup Datacenter Tables
- Setup Server Lifecycle Table
- Setup Virtualization Domains Table
- Setup Workload Factor Table
- Setup Operating System Table
- Setup Middleware Table
- Setup System z Performance, Cost, & Power Tables

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.
Linux/x86+RISC	291.00	958.33	0.00	0.00	0.00	0.
AIX	0.00	0.00	0.00	0.00	0.00	0.
HP/UX Ent.	0.00	1,395.00	0.00	0.00	0.00	0.
Solaris	0.00	0.00	0.00	0.00	0.00	540.
VMware ESX	0.00	0.00	0.00	0.00	0.00	0.
Linux/z	0.00	0.00	0.00	0.00	0.00	0.
	0.00	0.00	0.00	0.00	0.00	0.

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 GHz

    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.

Return To Workflow
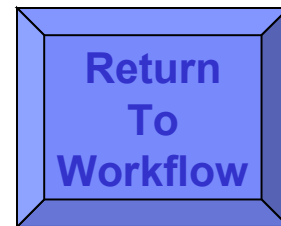
Subject Servers Input Sheet

Specify your server inventory here…

		Server Number
5	0	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	ProLiant
	Model	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

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 family

  LPAR-based sizing
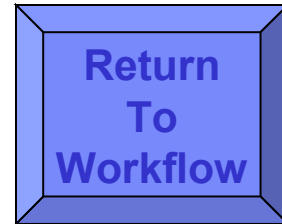
  Override #LPARs

  Override #CECs
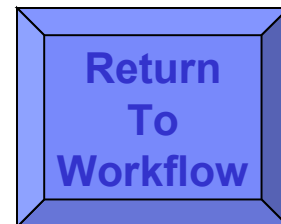
Target Server Setup and Processing Co

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

Memory Sheet

- Per Virtualization Domain…

- Target Case Memory Requirements Calculations

  Including target hypervisor memory requirements

- Sizing Analysis

 Determine number of target servers required to satisfy memory demands

Memory Constraint Analyzer

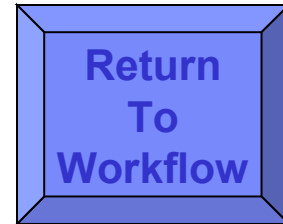| Case 1		
Virtual Domain:	**Production7x24**	**Production**
Memory QoS Categories Memory Requirements (MBs)		
Production	0	3072
Non-Production	0	0
0	0	0
Memory QoS Overcommit Ratios		
Production	1	1
Non-Production	1	1
0	1	1
Adjusted Memory Requirement		
Production	0	3072
Non-Production	0	0
0	0	0
Total Adjusted Memory	0	3072

I/O Sheet
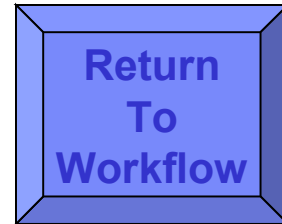
- Per Virtualization Domain…
- Target Case I/O Configuration Analysis
- Server Fiber Channel Ports (Host Bus Adapters)
- Server Network Interface Cards (NICs) - aka OSA Cards

I/O Configuration and Constraint Analyzer

| Case 0	Mixed	Subject Servers	
Virtual Domain:	Production7x24	Production	QualityAssurance
Configuration Analysis			
Server FiberChannel Ports			
Number of Physical Servers	0	1	0
Number of FiberChannel Ports/Server (HBAs)	2	2	2
Total Number of FiberChannel Ports	0	2	0
Server Network Ports (NICs)			
Number of Physical Servers	0	1	0
Number of Network Ports/Server	3	3	3
Total Number of Network Ports	0	3	0

Hypervisor Sheet

Return To Workflow

- Per Virtualization Domain…

- Apply hypervisor limitations (constraints) to determine number of target servers required to satisfy virtual machine demands

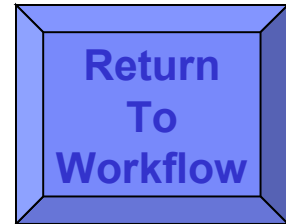| Case 3	HPQ	ProLiant	
Virtual Domain:	Production7x24	Production	QualityAssu
Hosting Server Vendor	HPQ	HPQ	HPQ
Hosting Server Make/Model/Config	ProLiant DL580 G4 (4U) Xeon Dual Core 7140M 3.4GHz 16MB (4ch/8co)	ProLiant DL580 G4 (4U) Xeon Dual Core 7140M 3.4GHz 16MB (4ch/8co)	ProLiant D G4 (4U) X Dual Core 7 3.4GHz 16 (4ch/8co)
Hypervisor	VMware	VMware	VMwar
Cores	8	8	8
Constraining Condition 1			
Maximum Virtual Images Per Server	128	128	128
Number of Virtual Machines Required	0	1	0
Minimum Servers Required	0	1	0
Constraining Condition 2			
Maximum Virtual Images Per Core	6	6	6
Number of Cores in VMware Server	8	8	8
Maximum VMware "Images" Per Server	48	48	48
Number of Virtual Machines Required	0	1	0
Minimum Servers Required	0	1	0
Constraining Condition 3			
Maximum Virtual Images Per Customer Standard	30	30	30
Number of Virtual Machines Required	0	1	0
Minimum Servers Required	0	1	0
Constraining Accommodation			
Minimum Servers Required per Hypervisor Constraints	0	1	0

Constraints Sheet
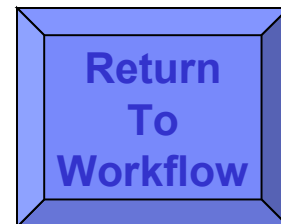
- Per Virtualization Domain…

- Resolve to an unconstrained target server configuration (finalize the number of servers)

  - Unconstrained by processing demands

  - Unconstrained by memory demands

  - Unconstrained by hypervisor demands

- Assign target servers to datacenters

Constraint Resolution

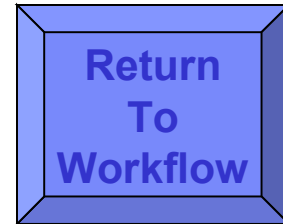| Case 1			
Virtual Domain:	Production7x24	Production	QualityAssura
Hosting Server Vendor	DEL	DEL	DEL
Hosting Server Make/Model/Config	PowerEdge SC1425 (1U) Xeon EM64T 2.8GHz-LV 1MB (2ch/2co)	PowerEdge SC1425 (1U) Xeon EM64T 3.0GHz 1MB (2ch/2co)	PowerEdge SC1425 (1U Xeon EM64T 2.8GHz-LV 1M (2ch/2co)
Chips	2	2	2
Cores	2	2	2
Total Chips	0	2	0
Total Cores	0	2	0
Servers			
CPs Constrained Config Servers Req'd	0	1	0
RAM Constrained Servers Req'd	0	1	0
Hypervisor Constrained Servers Req'd	0	0	0
Minimum Number of Servers	0	1	0
Server Allocations Per Datacenter			
DC1	0	1	0
Override			
DC1	0	1	0
DC2			
DC3			
DC4			
DC5			
DC6			
DC7			
DC8			
DC9			
DC10			
This Sum Should Equal Min Num Servers	0	1	0

Datacenters Sheet

Return To Workflow

- Energy costs per datacenter
- Floorspace costs per datacenter
- Racks – configuration and costing
- Blades chassis – configuration and costing

Data Center Analysis -- Subject Servers

Selected Data Center Data	DC1	DC2	DC3
Energy Cost per Watt-hr	0.00010	0.00010	0.00010
Frame Space Cost	300.00	300.00	300.00
Frame Service Space Cost	300.00	300.00	300.00
Frame Support Space Cost	0.00	0.00	0.00
Frame Service Space Multiplier	1.5	1.5	1.5
Frame Support Space Multiplier	0.25	0.25	0.25
Rack Space Cost	300.00	300.00	300.00
Rack Service Space Cost	300.00	300.00	300.00
Rack Support Space Cost	0.00	0.00	0.00

Software Sheet

Return
To
Workflow

- Per Virtualization Domain…

- Configure and Cost Target Server Operating Systems

- Configure and Cost Target Server Middleware

- Substitutions Allowed

- License Porting Handled

Software Configuration and Costing

Case 1		

Server Domain - Production7x24		
Hardware Configuration	DEL	PowerEdge SC142
Quantities	Servers	0
	Primary OS	Scondary OS
Target Server Operating System	WIN2K	Linux/x86
Pricing Unit	Core	Server
Override		
Operating System Pricing Unit	Core	Server
Operating System License Unit Price	2000	100
Operating System S&S Unit Price	500	100
Pricing Quantity	0	0
Quantity Override	1	1
Selected Quantity	1	1
Operating System License Extended Price 2100	2000	100
Operating System SS Extended Price 600	500	100

Hyperware Sheet
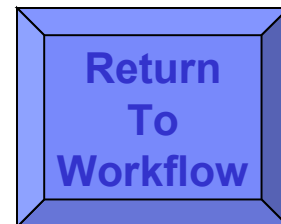
- **Configure and Cost Hypervisor-Based Software**

  z/VM and companion products

  VMware editions

  Foundation, Standard, Enterprise

  PowerVM editions

  Express, Standard, Enterprise

Hypervisor Software Configuration and Costing

Case 2		IBM	zNext			z/VM	
		IFL-based Value-Unit Priced Products in This Section					
Product Name		z/VM V5	RACF	DirMaint	Performance Toolkit	Backup/Restore Mgr	Tape Mgr
Product ID		5741-A05	5741-A05	5741-A05	5741-A05	5697-J06	5697-J08
Put In Configuration?...		Yes	Yes	Yes	No	No	No

IBM

Admin Sheet
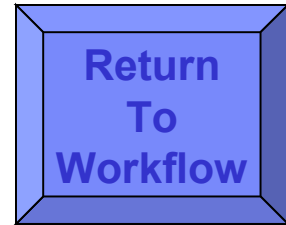
Allocate admin task timing to the physical servers, to the hypervisors, and to the virtual servers

Tasks organized around the lifecycle of a server
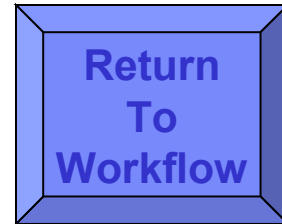
Acquire > Install > Operate > Retire

Generate an FTE Ratio

Number of servers an admin can administer

|	Subject Servers		z/VM			VMware		
	Physical (e.g. DL585)	Linux WIN2K	Physical (e.g. z9)	Virtual (Linux)	Hypervisor (z/VM)	Physical (e.g. DL585)	Virtual (Linux)	Hypervisor (VMware)
Admin Work Hours Per Day	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
Admin Work Days Per Week	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Admin Work Weeks Per Year	49.0	49.0	49.0	49.0	49.0	49.0	49.0	49.0
Admin Work Years In Analysis Period	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Total Admin Hours In Analysis Period	11025.0	11025.0	11025.0	11025.0	11025.0	11025.0	11025.0	11025.0
Servers Administered Per Admin	13.0	19.9	4.7	99.9	9.5	7.4	50.8	8.6

IBM

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

Return To Workflow

Facts and Figures Sheet

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

Power Analysis	Case 0	Case 1
Manufacturer/Vendor	Mixed	DEL
Server/Model	Subject Servers	PowerEdge
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
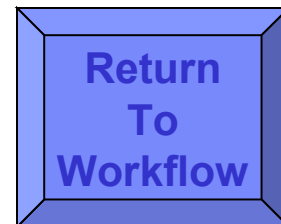
RACEv Cost Analysis
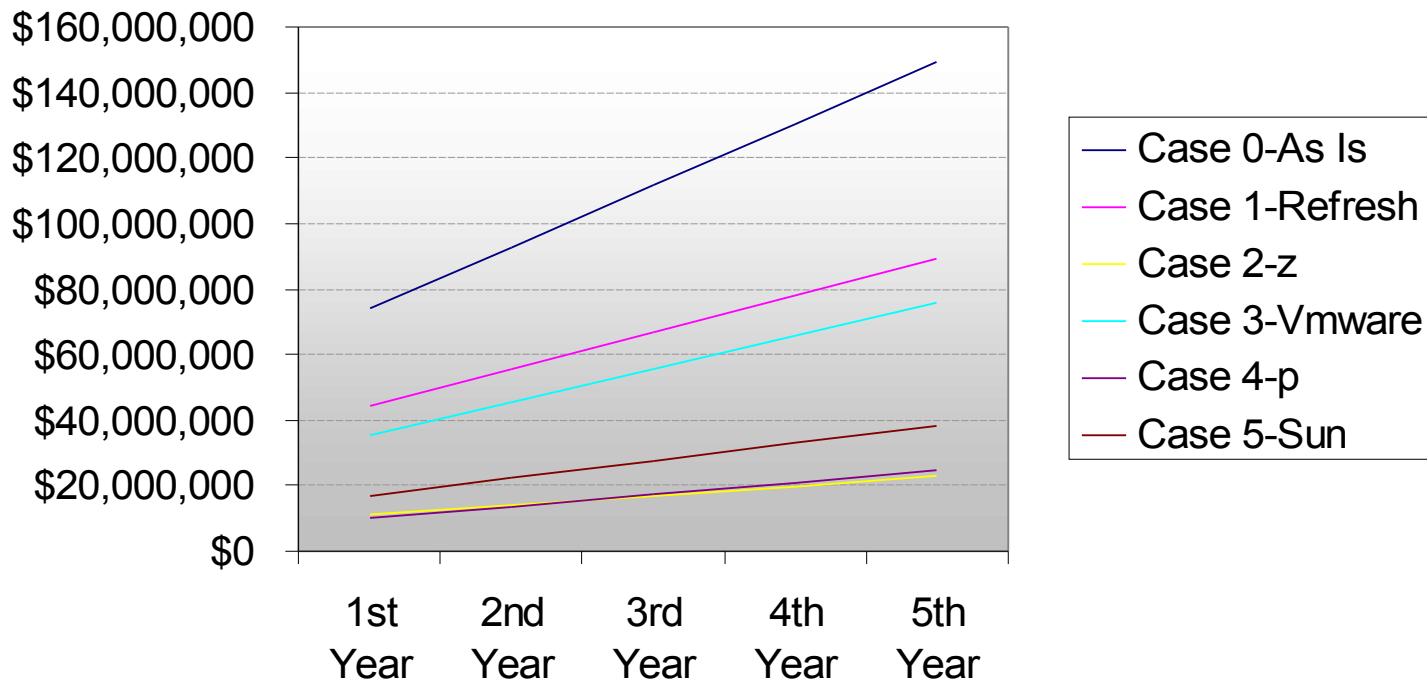
Case ID	1st Year	2nd Year	3rd Year	4th Year	5th Year	Rank
Case 0-As Is	$73,881,248	$92,687,237	$111,493,225	$130,299,214	$149,105,203	6
Case 1-Refresh	$44,435,000	$55,603,045	$66,771,091	$77,951,636	$89,132,182	5
Case 2-z	$11,130,700	$14,045,991	$16,961,282	$19,876,573	$22,791,864	1
Case 3-Vmware	$35,406,280	$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

End of Section

RACEv New Features and New News

Advanced Function: Favorites Sheet

- What if (iterative) analysis capability
- Copy-by-value of "key" modeling outputs
  - As many times as required
- Then compare run by run by run
  - Watch key output variables change
    - Sensitivity analysis

Advanced Function: Hybrid-Mode

- **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 (NEW)**
  - 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
      - Can you do that in an afternoon w/your spreadsheet? ;-)

New News: "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…?"

New News: Alinean™ and zLinux TCO Tool

- "Take the HP Challenge" kinda thing

- Set for release soon

- By invitation only

- Send me (mbauman@us.ibm.com) a message to get an invitation

End of Section

Conclusion

Final Remarks

- RACE

  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

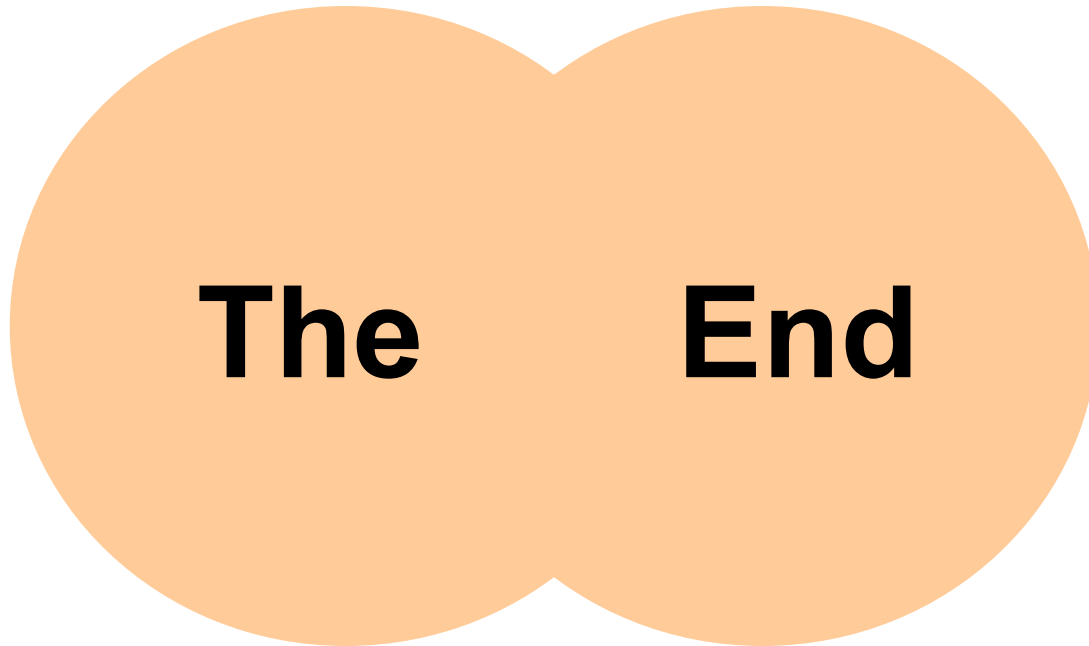 No-charge offering from IBM technical support specialists

- For more information… requests… autographs… ;-)

  mbauman@us.ibm.com

End of Section

End of Document

Comments?

Questions?

The **End**

Suggestions?