IBM z Systems – Redefining Digital Business

Building the business case for cloud, analytics and mobile computing

Competitive Project Office

Agenda

1. Positioning your enterprise for cloud, analytics and mobile computing
2. The mainframe and mobile computing: A perfect match
   Break (15 minutes)
3. Scoring fast and winning big with analytics on z Systems
   Lunch (60 minutes)
4. Implementing hybrid clouds with z Systems
   Break (15 minutes)
5. Easy and agile development and administration for cloud, analytics and mobile computing
6. **Building the business case for cloud, analytics and mobile computing**
   Wrap up and Q&A

Competitive Project Office

We've covered a lot of information today about digital business and IBM z Systems…

Up to 40% more capacity…

2x faster I/O bandwidth…

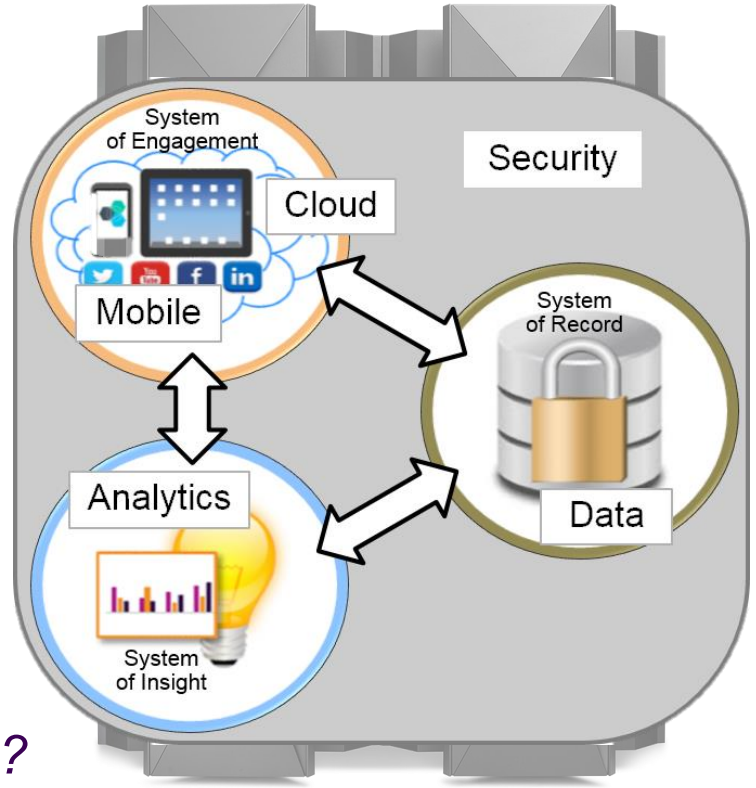
3x more memory…

38% improvement for zIIPs with SMT…

60% reduction in costs with Mobile Workload Pricing…

94% lower cost per throughput with BigInsights on z…

32% lower cost for z Systems private cloud than x86



…what's your next step?

Competitive Project Office

The challenge when creating a business case is to relate *IT value* to *business value*

"IBM has shown us several use cases for cloud, analytics and mobile computing on z Systems…"

IT Department

"Okay, but what about our specific initiatives? Show me a business case!"

Executives

Competitive Project Office

When planning strategy, businesses first and foremost look at the financials

Balanced Scorecard (Kaplan and Norton)*

- Increase operating margin
- Grow shareholder value
- Reduce expenses
- Increase revenue

When making the business case for z Systems…

1. Use *Total Cost of Ownership* (TCO) instead of *Total Cost of Acquisition* (TCA)

2. Compare using *Cost per Unit of Work* metric

Competitive Project Office

Kaplan, Robert S; Norton, D. P. (1992). "The Balanced Scorecard - Measures That Drive Performance". *Harvard Business Review*

To understand costs, it's important to know the difference between TCO and TCA

Components	Environments					Time
	Prod					
Hardware	$					
Software	$					

Total Cost of Acquisition = Hardware + Software costs (over 3 years)

Competitive Project Office

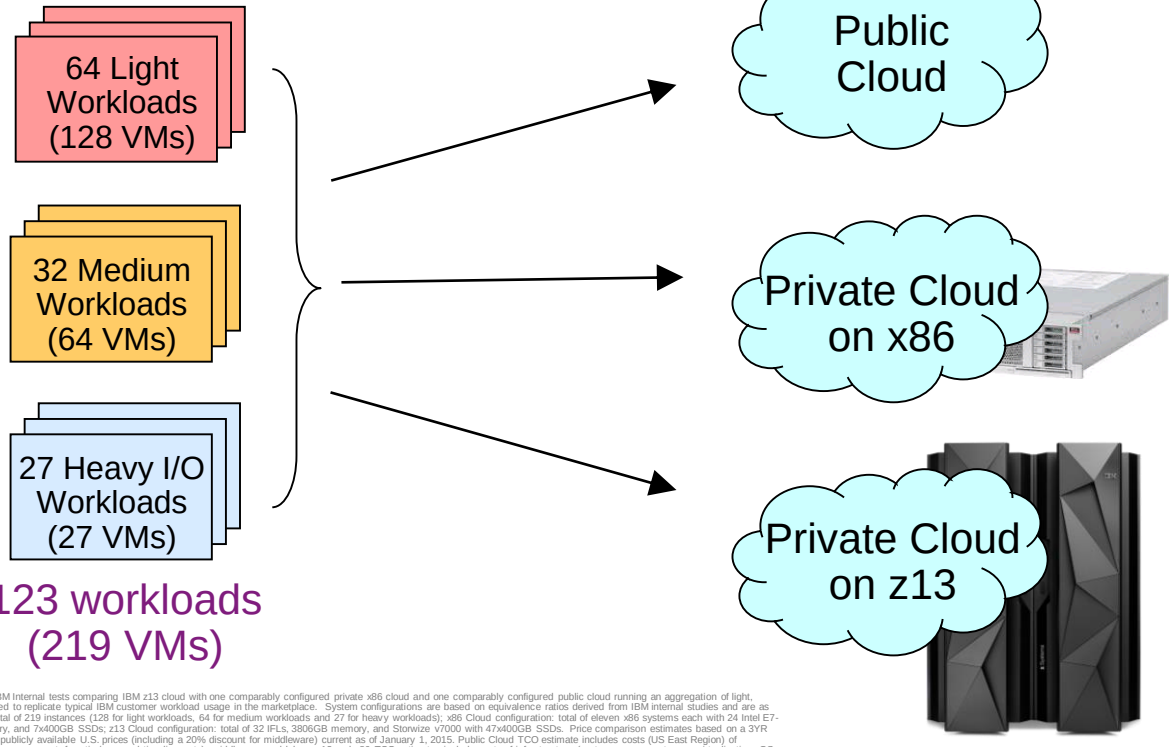
To understand costs, it's important to know the difference between TCO and TCA

Components	Environments					Time
	Prod	Dev	Test	QA	DR	
Hardware	$	$	$	$	$	Planning
Software	$	$	$	$	$	Upgrades
People	$	$	$	$	$	Migration
Network	$	$	$	$	$	Growth
Storage	$	$	$	$	$	Parallel Costs
Facilities	$	$	$	$	$	Net Present Value
QoS – Availability, Reliability, Security and Scalability						

Total Cost of Ownership is much more than Total Cost of Acquisition!

Competitive Project Office

Our Cloud study was a good example of a TCO comparison…



219 instances
$17.6M (3yr TCO)

264 x86 cores
$10.3 (3yr TCO)

32 IFLs
$7.0M (3yr TCO)

32% Less than x86 cloud*

60% Less than public cloud*

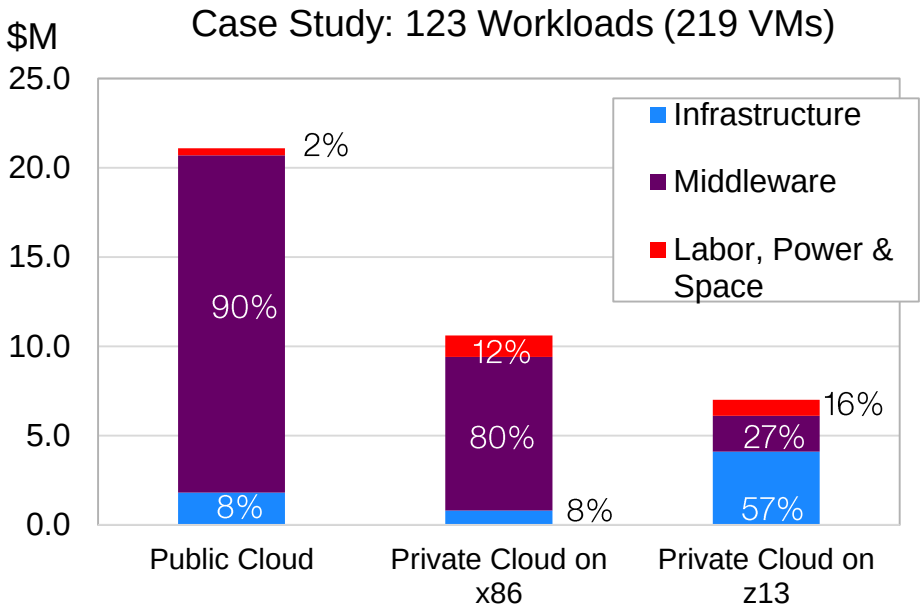
*estimated

Competitive Project Office

Performance comparison based on IBM Internal tests comparing IBM z13 cloud with one comparably configured private x86 cloud and one comparably configured public cloud running an aggregation of light, medium and heavy workloads designed to replicate typical IBM customer workload usage in the marketplace. System configurations are based on equivalence ratios derived from IBM internal studies and are as follows: Public Cloud configuration: total of 219 instances (128 for light workloads, 64 for medium workloads and 27 for heavy workloads); x86 Cloud configuration: total of eleven x86 systems each with 24 Intel E7-8857 v2 3.0GHz cores, 512GB memory, and 7x400GB SSDs; z13 Cloud configuration: total of 32 IFLs, 3806GB memory, and Storwize v7000 with 47x400GB SSDs. Price comparison estimates based on a 3YR Total Cost of Ownership (TCO) using publicly available U.S. prices (including a 20% discount for middleware) current as of January 1, 2015. Public Cloud TCO estimate includes costs (US East Region) of infrastructure (instances, data out, storage, support, free tier/reserved tier discounts), middleware and labor. z13 and x86 TCO estimates include costs of infrastructure (system, memory, storage, virtualization, OS, cloud management), middleware, power, floor space and labor. Results may vary based on actual workloads, system configurations, customer applications, queries and other variables in a production environment and may produce different results. Users of this document should verify the applicable data for their specific environment.

Our Cloud TCO case used many different parameters to cover the full spectrum of costs

- **More than 30 cost variables**
  - System and IFL amount and costs
  - Memory amount and costs
  - Storage amount and costs
  - PVU counts
  - Cost of hypervisors
  - Cost of cloud management software
  - Cost of operating system
  - Cost of middleware
  - Cost of hypervisor maintenance
  - Cost of cloud management maintenance
  - Cost of operating system maintenance
  - Cost of middleware maintenance
  - Power consumption
  - Cost of power
  - Space taken
  - Cost of space
  - Admin rate
  - Efficiency factors for labor
  - Number of FTE
  - Number and type of instances
  - Cost of instances
  - Amount of data out
  - Cost of data out
  - Enterprise support costs



Competitive Project Office

Cost per Unit of Work represents the price performance ratio

2 Costs

÷ *(Do the math)* =

Cost per Unit of Work

Cost	$3,652,131
Reports per Hour (RpH)	92,095
Cost per RpH	$40

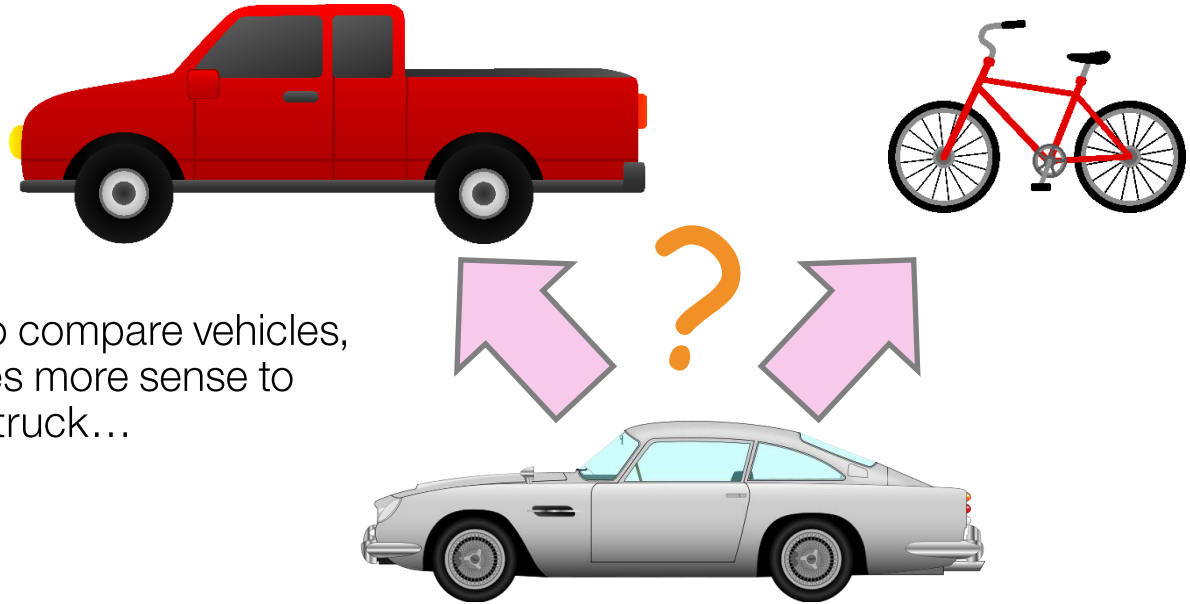
1 Measurements

Establishing equivalence between options for comparison is critically important

Competitive Project Office

Establishing equivalence, step 1: Determine the type of system needed to run the test

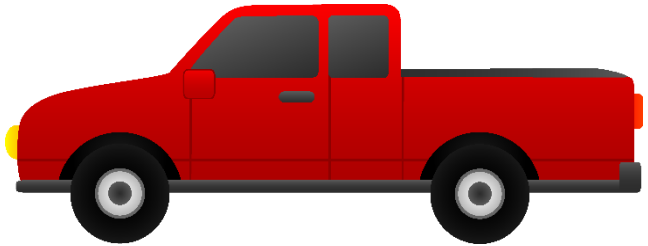
1



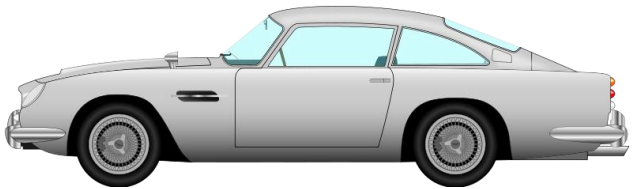
If we want to compare vehicles, then it makes more sense to choose the truck…

Competitive Project Office

Establishing equivalence, step 2: Make sure each system has the same *capabilities*



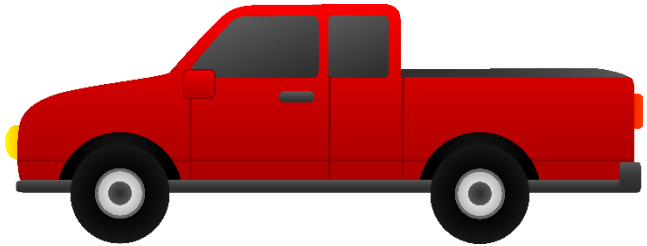
Is it an apples to apples comparison yet?



Competitive Project Office

Establishing equivalence, step 2: Make sure each system has the same *capabilities*

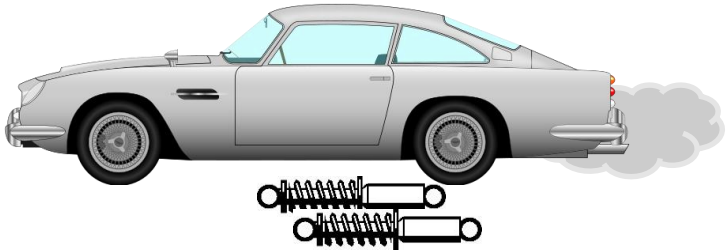
Number of passengers



SPEED!

Hauling capacity

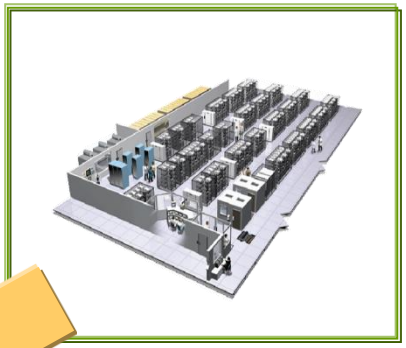
Engine horsepower



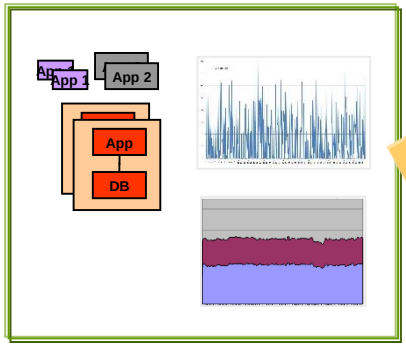
Competitive Project Office

Establishing equivalence is critically important to making valid measurements

We are often asked to compare x86 to z Systems…



Atomic benchmarks and measures, analysts evaluations



Customer experience, real-world use cases

- Chip architecture
- I/O subsystem
- Networking
- High availability
- Compiler efficiency
- Workload consolidation
- Disaster recovery

Competitive Project Office

Architecture comparison demonstrates several platform differences

Typical utilization 70-90%

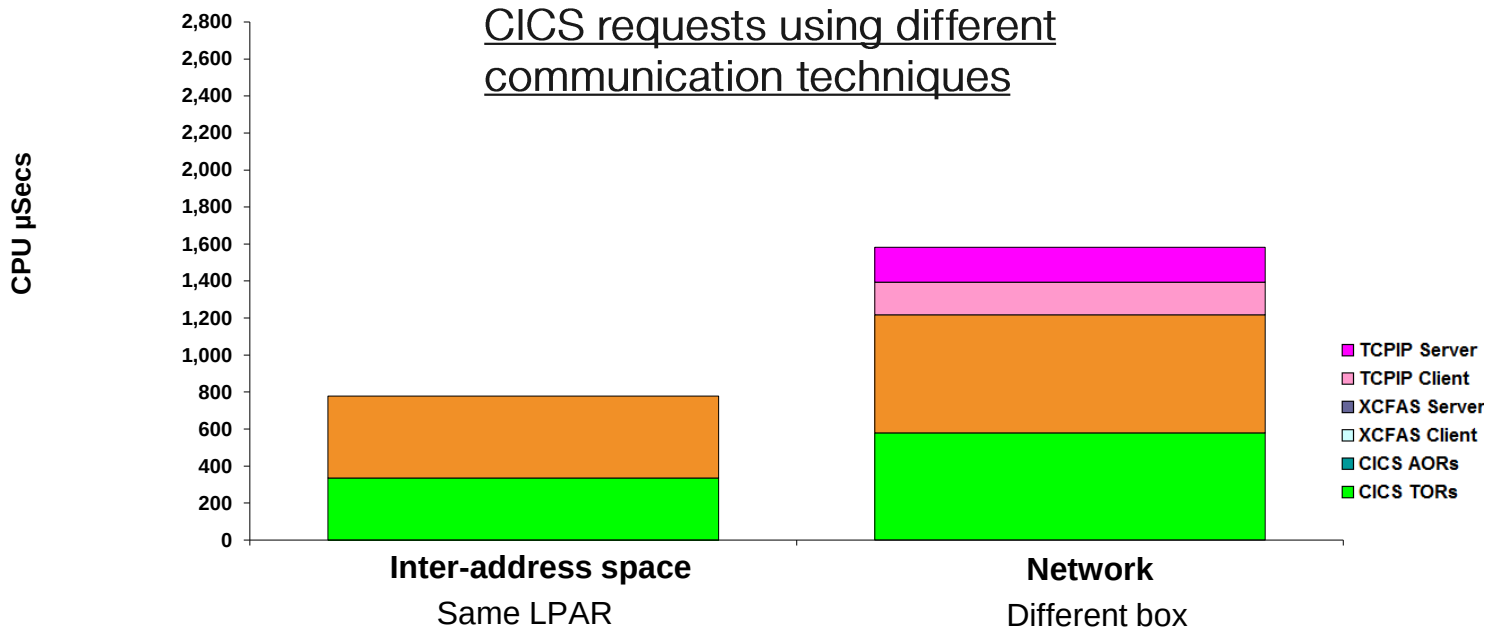
Typical utilization 10-20%

	z13	**"Performance" Intel x86 processor**
Core speed (operational)	5.0 GHz	4.0 GHz (4.4 GHz Turbo)
Cache	L1+L2: 4.224 MB /core L3: 64 MB /chip (8 cores) L4: 960 MB total (shared)	8 MB (total) (no L4 cache)
Dedicated I/O subsystem	Yes	No
Workload management*	Tests show high priority workloads do not degrade when low priority workloads added; virtually all resource used efficiently	High priority workloads degraded significantly when low priority workloads added; too much resource remained unused

Competitive Project Office

* IBM internal test. x86 used most popular virtualization software.

Co-locating in the same address space is more efficient than networking between server boxes



Source: http://hurgsa.ibm.com/projects/t/tp_performance/public_html/OS390CICS/reports/CICS%20TS%20V4.2%20Performance.ppt and email with z/OS Communications Server development team

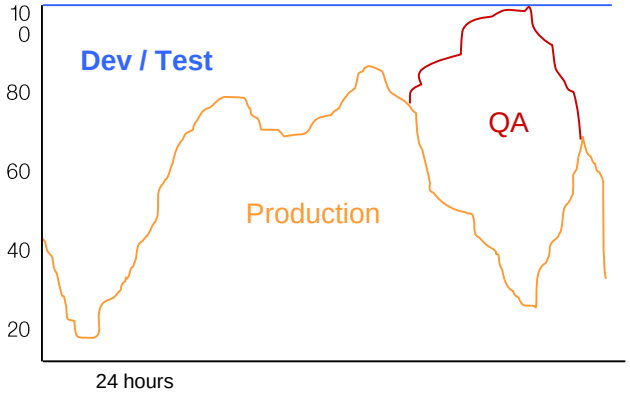
Competitive Project Office

Non-production environments require fewer resources on the mainframe

- Development and Test Capacity
  - Mainframe – Prod +20%
  - Distributed – a range, sometimes Prod +200%

Production *QA* *Dev/Test*

Mainframe Usage Profile



Competitive Project Office

Source: IBM Eagle Team

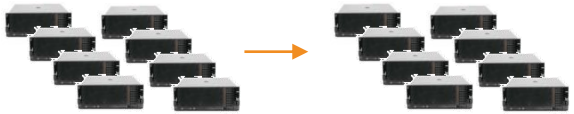
More servers are required on distributed platforms to support high availability

Mainframe High Availability

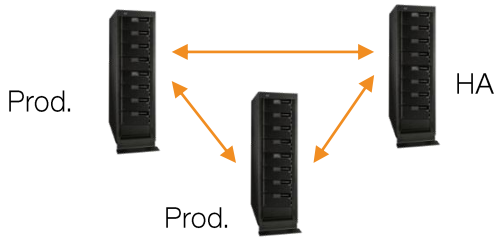
Single System Parallel Sysplex

HA contained within the production box

Distributed High Availability



(1) Dedicated *failover – full replication* of all production boxes



(2) N+1 clustered failover – at least one additional box required

Competitive Project Office

Real world customer offload cases validate the internal tests

Customer #1

3 x HP DL580 (2ch/20co)
Production / Dev / Test

No Disaster recovery

60 Cores

(2011 technology)

z800 running
Production / Dev / Test

2.1 processors
(499 MIPS)

(2002 technology)

Customer #2 (on-going*)

5 x 12 cores
Production / Dev / Test

1 x 16 cores
Data Mgmt Services

1 x 14 cores
Systems Mgmt

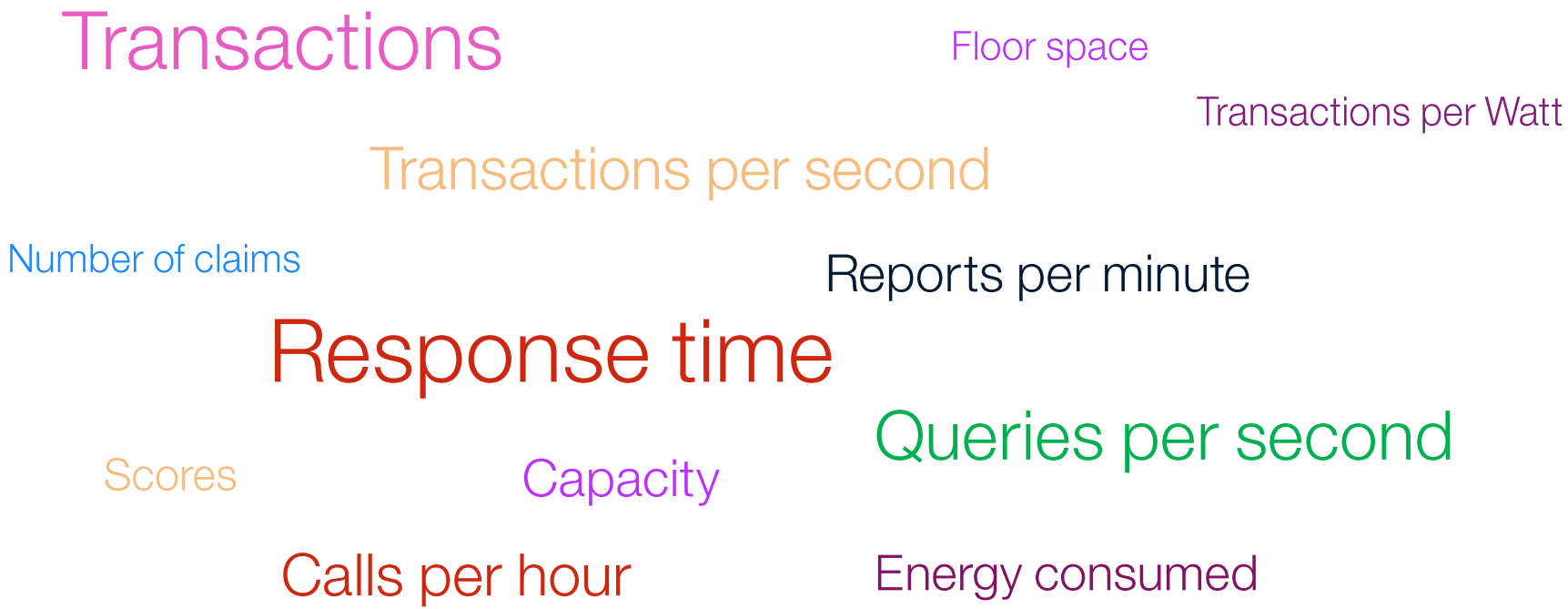
90 Cores

4.6 processors
(1,100 MIPS)

Competitive Project Office

* Fourteen cores to data, with a projected 24 additional production cores added on completion for High Availability

Establishing equivalence, step 3: Do the tests and collect the data that's important to you



Competitive Project Office

Cost per Unit of Work is probably the single most important value on which to focus

Which is the better buy?

Cost per Unit of Work is a Unit Price

- For computing, these measurements are often based on
  - Quantity
    - Cost per report, cost per transaction (long running)
  - Capacity / Rate
    - Cost per transaction per second (short running, high volumes)

Competitive Project Office

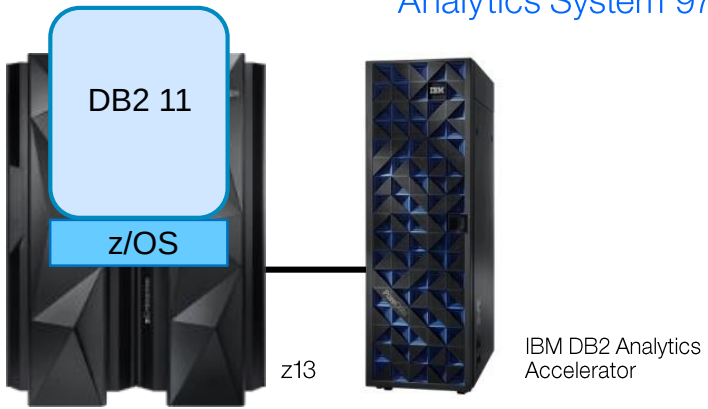
We talked about Cost per Unit of Work when we talked about Analytics

Standalone
Pre-integrated
Competitor V4

1a

Eighth Unit

IBM zEnterprise
Analytics System 9700



Cost	$2,746,000
Reports per Hour (RpH)	5,343
Cost per RpH	$514

2

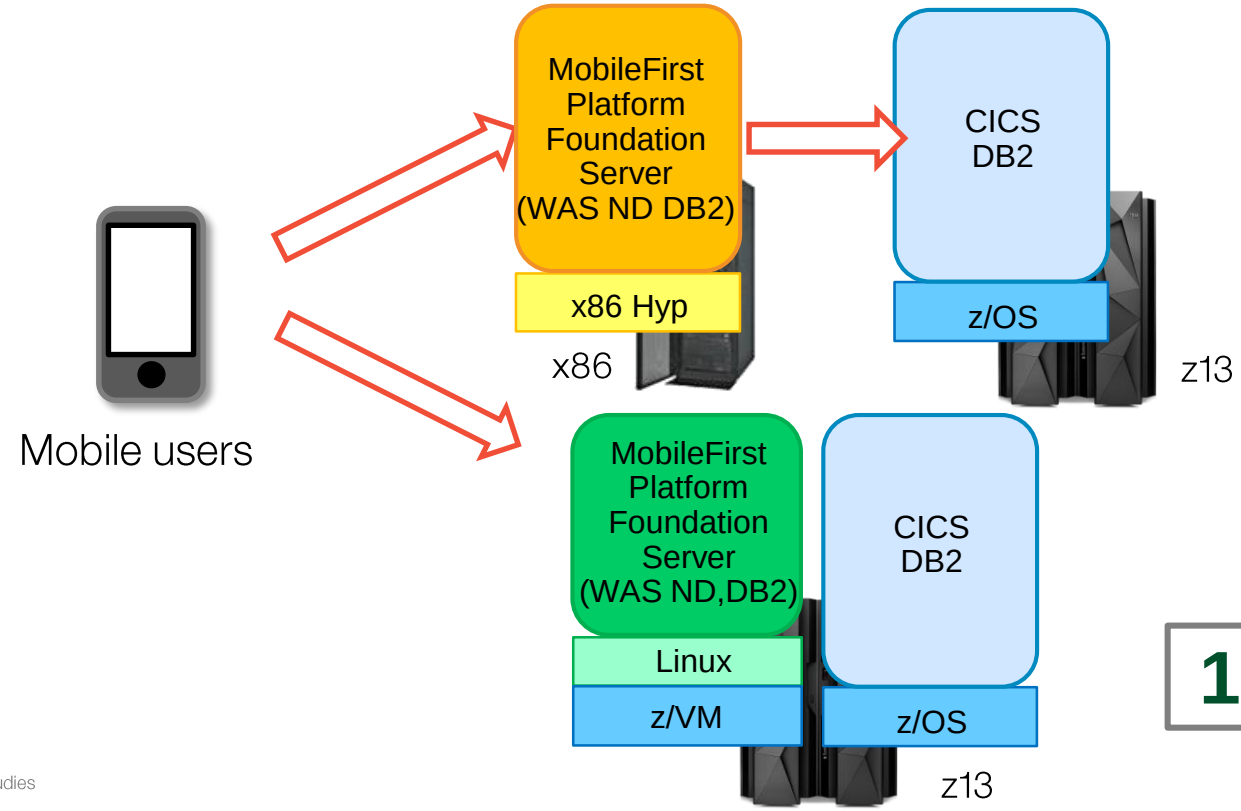
1b

Cost	$3,652,131
Reports per Hour (RpH)	92,095
Cost per RpH	$40

Competitive Project Office

Source: IBM Internal Studies. List prices used.

We also had a Cost per Unit of Work example in the mobile discussion



2,145 tps
$2,490 per tps

3,446 tps
$2,070 per tps

17% Lower cost per tps

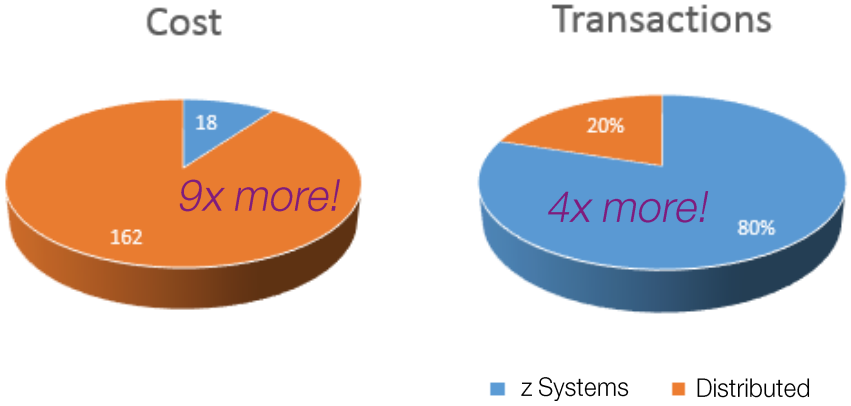
Source: IBM Internal Studies

Competitive Project Office

A simple example can illustrate the full picture

A recent IT Economic Study:

- **Costs**
  - Total infrastructure costs - $180M
  - Mainframe costs - $18M
  - Distributed costs - $162M
- **Workload**
  - Mainframe
    - 70% of mission critical apps
    - 80% of business transactions
    - 80% of the data
  - Distributed
    - Remaining 30% of critical apps
    - Remaining 20% of business transactions
    - Remaining 20% of the data



Cost per unit of work was **36x more** on distributed platform than on z platform

Mainframes account for **68%** of production workloads, but only **6.2%** of IT spend

Competitive Project Office

Source: Solitaire Interglobal, 2014

Platform economics data shows mainframe-heavy businesses are more cost efficient

Dr. Howard Rubin, Rubin Worldwide, 2015:

Industry	Measure	Average IT Cost of Goods	Mainframe Heavy	Commodity Server Heavy	% Mainframe Cost Less than Server	2010-2011 Differential	Change
Bank	Per Teller Transaction	$ 0.300	$ 0.125	$ 0.401	69%	67%	2%
Mortgage	Per Approved Loan	$ 295.30	$ 100.20	$ 358.40	72%	68%	4%
Credit Card	Per Transaction	$ 0.138	$ 0.094	$ 0.192	51%	48%	3%
Railroads	Per Ton Mile	$ 0.0011	$ 0.0012	$ 0.002	39%	36%	2%
Armed Service	Per Person	$ 9,410	$ 7,124	$ 12,544	43%	35%	9%
Automotive	Per Vehicle	$ 382	$ 279	$ 413	32%	31%	1%
Retail	Per Store/Door	$ 560,266	$ 453,444	$ 675,899	33%	27%	6%
Utilities	Per MegaWatt Hour	$ 2.58	$ 2.50	$ 3.35	25%	19%	6%
Hospitals	Per Bed per Day	$ 82.88	$ 62.32	$ 91.56	32%	27%	5%
Oil & Gas	Per Barrel of Oil	$ 2.33	$ 1.80	$ 2.61	31%	28%	3%
Consulting	Per Consultant	$ 58,650	$ 48,766	$ 68,100	28%	28%	1%
Trucking	Per Road Mile	$ 0.185	$ 0.160	$ 0.225	29%	20%	9%
Airlines	Per Passenger Mile	$ 0.009	$ 0.007	$ 0.010	36%	30%	6%
Chemicals	Per Patent	$ 66,588	$ 58,922	$ 68,566	14%	10%	4%
Web Sites	Per Search	$ 0.040	$ 0.042	$ 0.038	-11%	-8%	-2%
				Average	35%	31%	4%

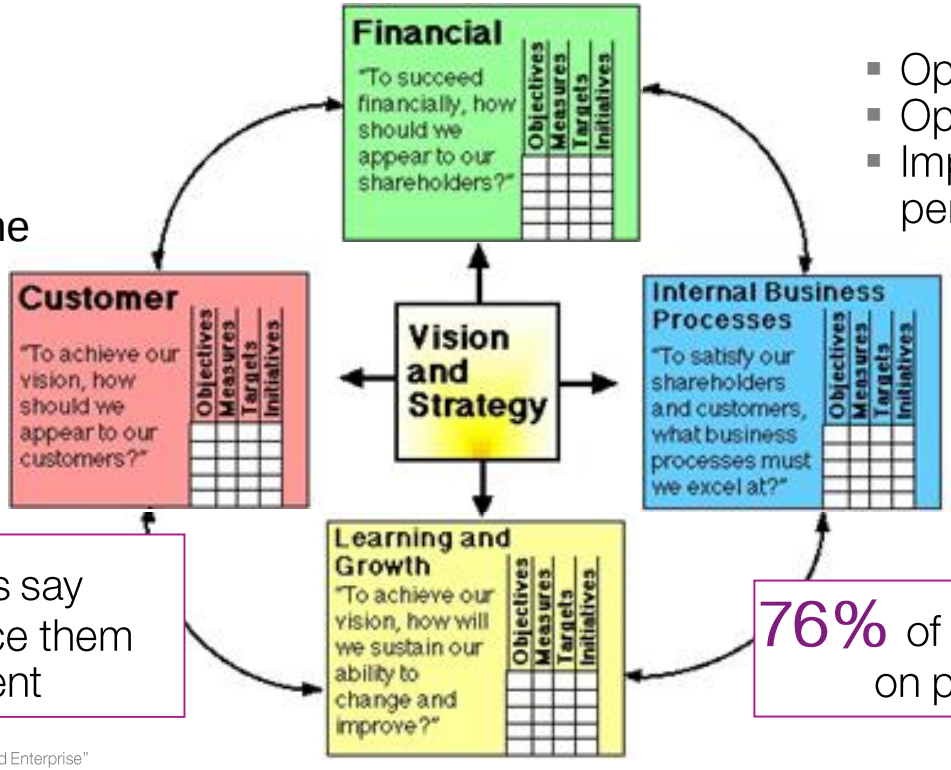
Mainframes cost on average 35% less to produce goods

Competitive Project Office

A compelling business case will also address more than just the financial aspect

Balanced Scorecard (Kaplan and Norton)*

- Provide top quality technical support
- Improve delivery time
- Increase customer satisfaction



- Optimize inventory levels
- Optimize sales efficiency
- Improve supply price performance

54% of CxOs say customers influence them to a *large* extent

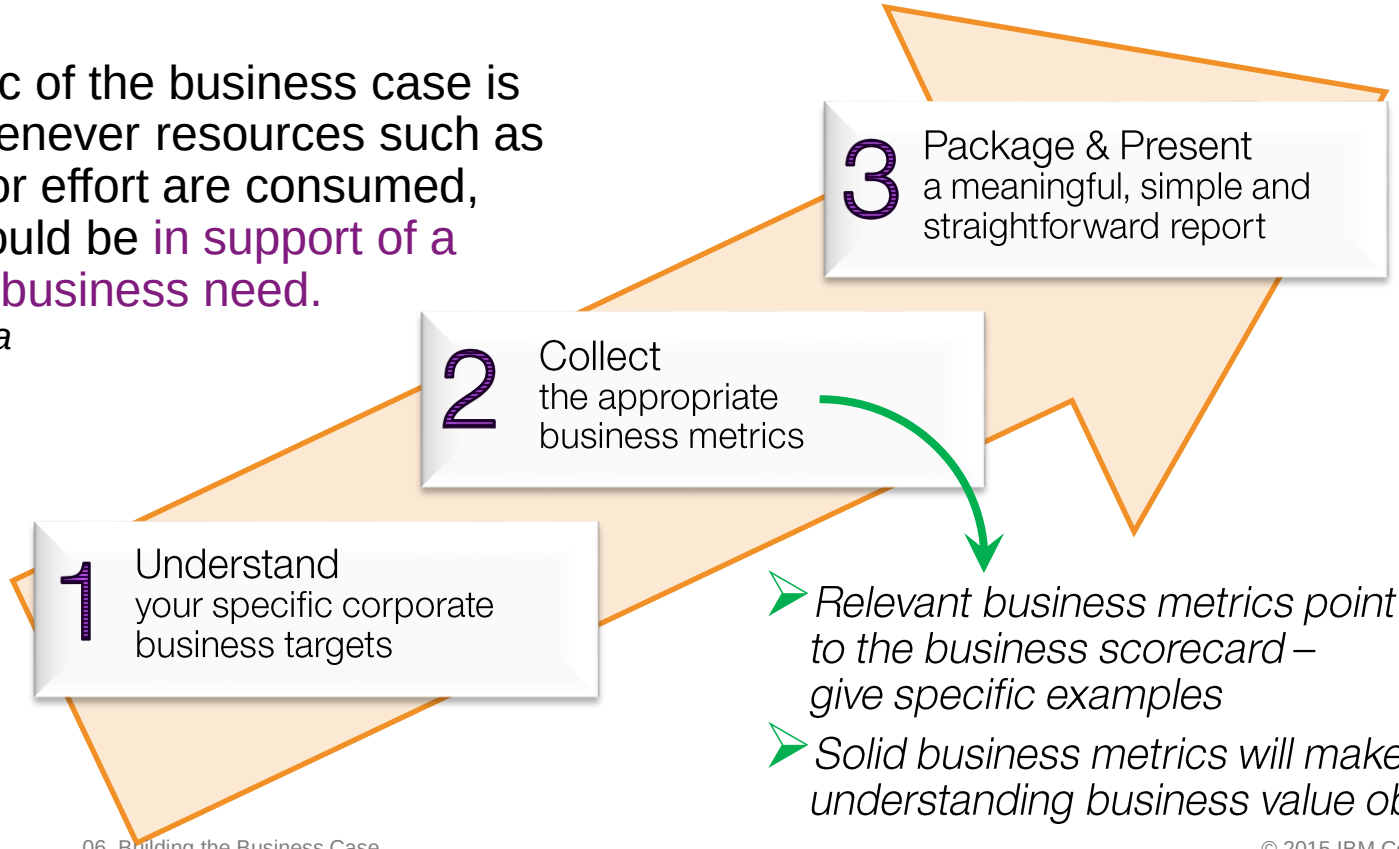
76% of CIOs are focused on people skills

*Source: IBM Institute for Business Value, "The Customer-activated Enterprise"

Competitive Project Office

A solid business case will make a compelling argument about *business value*

The logic of the business case is that, whenever resources such as money or effort are consumed, they should be in support of a specific business need.
- *Wikipedia*



- *Relevant business metrics point back to the business scorecard – give specific examples*
- *Solid business metrics will make understanding business value obvious*

Competitive Project Office

Mobile, analytics, and cloud top the list of CIOs' visionary plans*…

…so your challenge is to build a compelling case for z Systems as the platform of choice

IT data and metrics

- The z Systems platform:
- High availability
- Reliability
- Scalability
- Security
- Performance
- Virtualization
- Consolidation
- Co-location

What Business Value can be derived from the known IT Value?

Relevant business metrics

Put it all together for a compelling business value argument for Cloud, Analytics and Mobile computing on z

Competitive Project Office

*Source: IBM Institute for Business Value, "The Customer-activated Enterprise"

IBM Eagle Team - IT Economics Practice

Who we are

- Specialized in examining economic differences between platforms in client environments
- Focused on identifying areas for efficiencies and cost reductions
- Provide no-charge studies

Client benefits of engaging the Eagle Team

- Worldwide experience from successfully helping hundreds of clients since 2007
  - … most likely we have evaluated a similar scenario before
- Leverage research and benchmarks from the broader CPO
- We use client figures (not our own)
  - … through a transparent model
  - … with agreed-to assumptions
  - … and iterate as required
- Provide a business case from which the client can make a financially based IT decision

Competitive Project Office

Client Study #1: Bank with z Systems and proprietary UNIX servers

Issues to address:

1. z114 BC in D/R site needs to be replaced
   - Depreciation complete
   - End of maintenance reached
   - Insufficient capacity to handle workload
2. MLC cost needs to be controlled
   - Workload spike resulted in extraordinary charges
   - Mid/Long term decrease in MLC cost desired
3. Proprietary UNIX server inventory approaches end of life

Scenarios compared:

Case 1: z114 (budget/baseline at onset of study)

Case 1b: Batch optimized (alternative baseline)

Case 2: zBC12 technology refresh for z114 BC

Case 3: zBC12 + Oracle rehosting to zBC12

Competitive Project Office

Client Study #1: Scenario findings

- Keep System z inventory as is
- Apply batch and OLTP policies to prevent extraordinary profiles
- Use DEFINE CAPCITY to restrict MSUs
- Prohibit batch jobs from running concurrently with OLTP
- Refresh T4-4 HW in 2016 by T5-2 Server

- Reduce batch MSU peak to 130 by batch restructuring

Case 1: z114 (budget/baseline at onset of study)

Case 1b: Batch optimized (alternative baseline)

Case 2: zBC12 technology refresh for z114 BC

Case 3: zBC12 + Oracle rehosting to zBC12

- Continue restructure of batch for saving add'tl 8% of MSUs
- Replace z114 with zBC12 W02 @ reduced capacity (1380 MIPS/170 MSUs) + 2 IFLs
- Move z114 to D/R site to provide additional D/R capacity
- Refresh T4-4 HW in 2016 by T5-2 Server

- Replace z114 with zBC12 S03 @ reduced capacity (1243 MIPS/155 MSUs) + 5 IFLs
- Rehost Oracle Workload to zBC12 LPAR with 4 shared IFLs (3 required)
- Continue restructure of batch and limit batch MSUs to OLTP level (110 MSU)

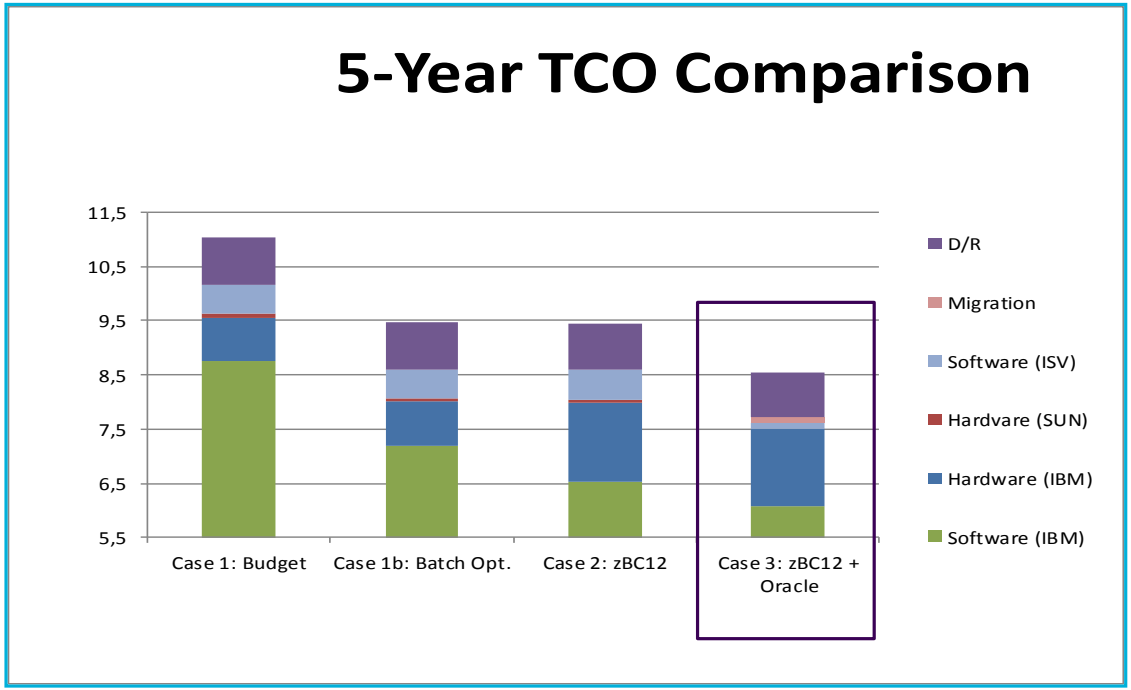
Competitive Project Office

IBM

Client Study #1: Financial analysis and recommendation

Update z114 BC to zBC12 and rehost Oracle workload on to zBC12 for lowest TCO

- Acquire new zBC12 for production workload
- Rehost Oracle DWH server with Linux on z



Competitive Project Office

Client Study #2: Government agency with z196

Issues to address:

1. Forecasted growth for agency will drive more mainframe usage
2. Would a distributed environment be more economical to address growth?
3. Determine cost of z/OS and major converged platform
4. z196 needs to be upgraded or replaced with a distributed solution

Scenarios compared:

Case 1: Existing z196 (baseline at onset of study)

Case 2: z13 upgrade, two options (160GB and 544GB memory)

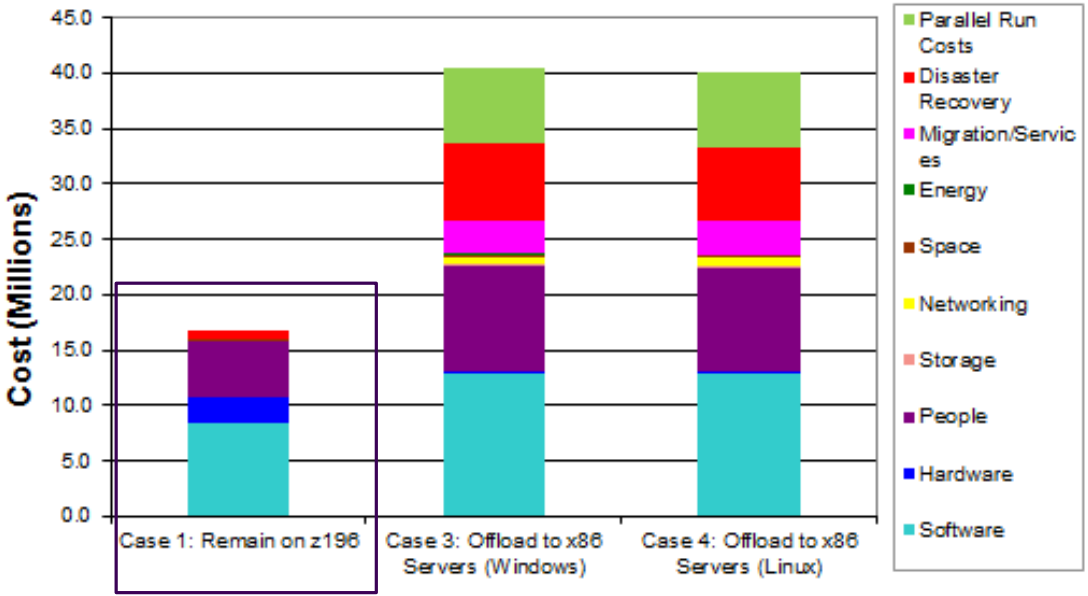
Case 3: Converged platform with Windows

Case 4: Converged platform with Linux

Competitive Project Office

Client Study #2: Scenario findings mainframe vs. converged platform

Total Cost of Ownership Comparison
IBM z/OS provides savings of $22M over 5 years



z196 **mainframe** environment found to be **less expensive** than converged platform

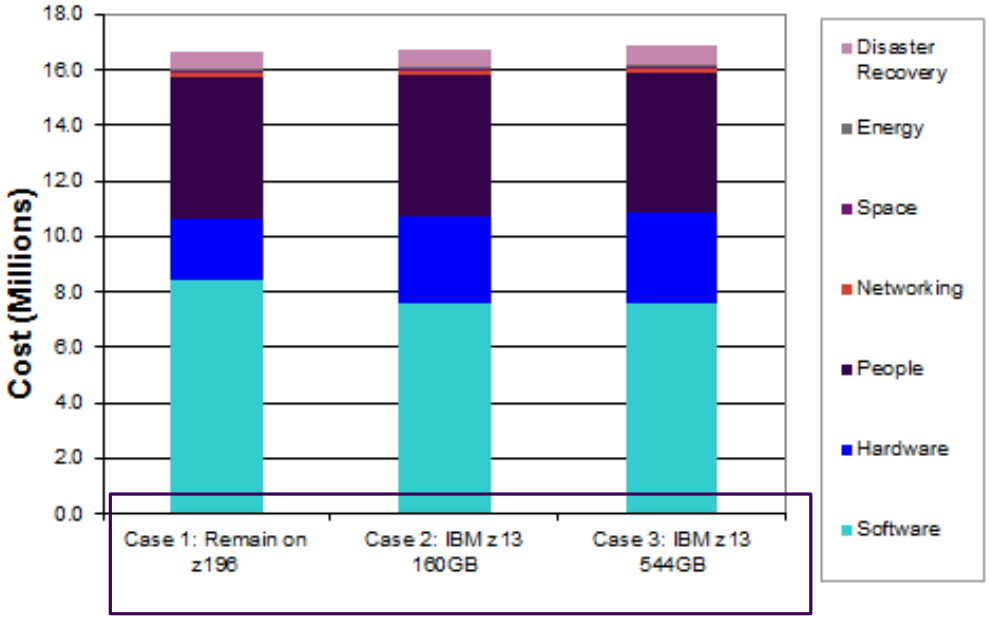
- Software costs are higher (190 cores in x86 environment vs. 10 processors (4 CP & 6 zIIP/zAAP))
- z196 provides many HA features; NOT included were HA distributed costs in study
- Migration and parallel operating environments are a significant impact to distributed cost
- Disaster recovery will double hardware, software, electricity, space, etc.

Competitive Project Office

Client Study #2: Scenario findings z196 vs. z13

Total Cost of Ownership Comparison

z13 provides greater capacity for almost same cost as z196



z13 found to cost about the same as z196 environment with greater capacity

- 38% more performance per processor
- 72% performance improvement of zIIP
- Lower maintenance costs on z13
- Lower MLC software costs on z13
- z13 with 160GB memory costs increase by $203k over 5 years
- z13 with 544GB memory costs increase by $394k over 5 years

Competitive Project Office

Client Study #2: Financial analysis and recommendation

Upgrade to z13 for about the same cost and greater capacity for business growth

IBM z13 EC provides 110-138% total performance improvement over z196 for about the same cost

Mainframe	GA date	MIPs per CP	MIPs Growth
z196	Sep-10	1,202	31%
zEC12	Sep-12	1,514	26%
z13	Mar-15	1,695	12%

z196 (160 GB): 5 Year TCO

z196 Cost	= $ 0
z196 Maintenance	= $ 2,227,462
MLC	= $ 5,417,515
IPLA (S&S)	= $ 3,015,198
Total	**= $10,660,175**

z13 (544 GB): 5 Year TCO

z13 Cost Upgrade	= $ 2,249,640
z13 Maintenance	= $ 913,252
MLC (-10%)	= $ 4,875,764
IPLA (S&S)	= $ 3,015,198
Total	**= $ 11,053,854**

Difference	= $	393,679	(+3.7%)
Per Year	= $	78,736	
Per Month	= $	6,561	

All performance information was determined in a controlled environment. Actual results may vary. Performance information is provided "AS IS" and no warranties or guarantees are expressed or implied by IBM.

Competitive Project Office

Use an IT Economics Study to support a z Systems business case

IBM Eagle Team – IT Economics Practice

Cloud Assessment

- Perform a Health Check to find the right private, public or hybrid cloud solution
- Examine workload size and activity, SLA and provisioning requirements, and instance costs

Workload Placement Assessment

- Consolidate, offload, and place new workloads on alternative platforms
- Exploit and compare platform attributes to optimize workload performance and costs

Analytics Assessment

- Determine the most cost-effective infrastructure for analytics solutions
- Exploit platform attributes and efficient storage solutions for Analytics and Big Data

Chargeback Analysis

- Align chargeback policies to actual IT costs
- Identify and overcome chargeback policies that drive adverse IT decisions

Mobile Assessment

- Mitigate high-volume, low-value mobile transaction costs
- Evaluate the effects of throughput, response time and other KPIs in mobile topologies

IT Best Practice Benchmarking

- Compare actual IT environment with best practices in the IT industry
- Improve forecast and actual spend

Available at **no-charge** to IBM clients and Business Partners

eagletco@us.ibm.com
www.ibm.com/iteconomics
IT Economics studies PartnerWorld

Competitive Project Office

IBM z Systems – Redefining digital business

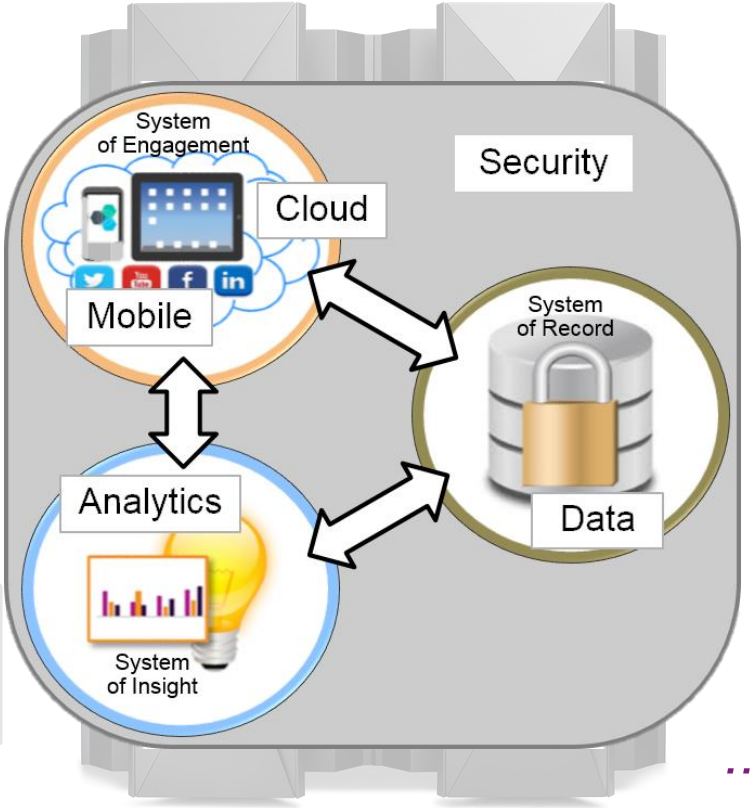
1.2M CICS tps *every day*

17% Lower cost per tps when MobileFirst runs on Linux on z

60% Reduction in costs with Mobile Workload Pricing

60+% zIIP offload for z13+DB2 11

39% Higher through-put for z13+DB2 11 than previous version



3.8x Better cost per workload for z13+ Analytics Accel. than competition

94% Lower cost per throughput with scoring on z

32% Lower TCO with z13 private cloud than x86 cloud

4,200+ z Systems job seekers

…The new IBM z13

Competitive Project Office

IBM z Systems – Redefining digital business…

- *The world's premier data and transaction engine enabled for the **mobile** generation*
- *The integrated transaction and **analytics** system for right-time insights at the point of impact*
- *The world's most efficient and trusted **cloud** system that transforms the economics of IT*

Competitive Project Office