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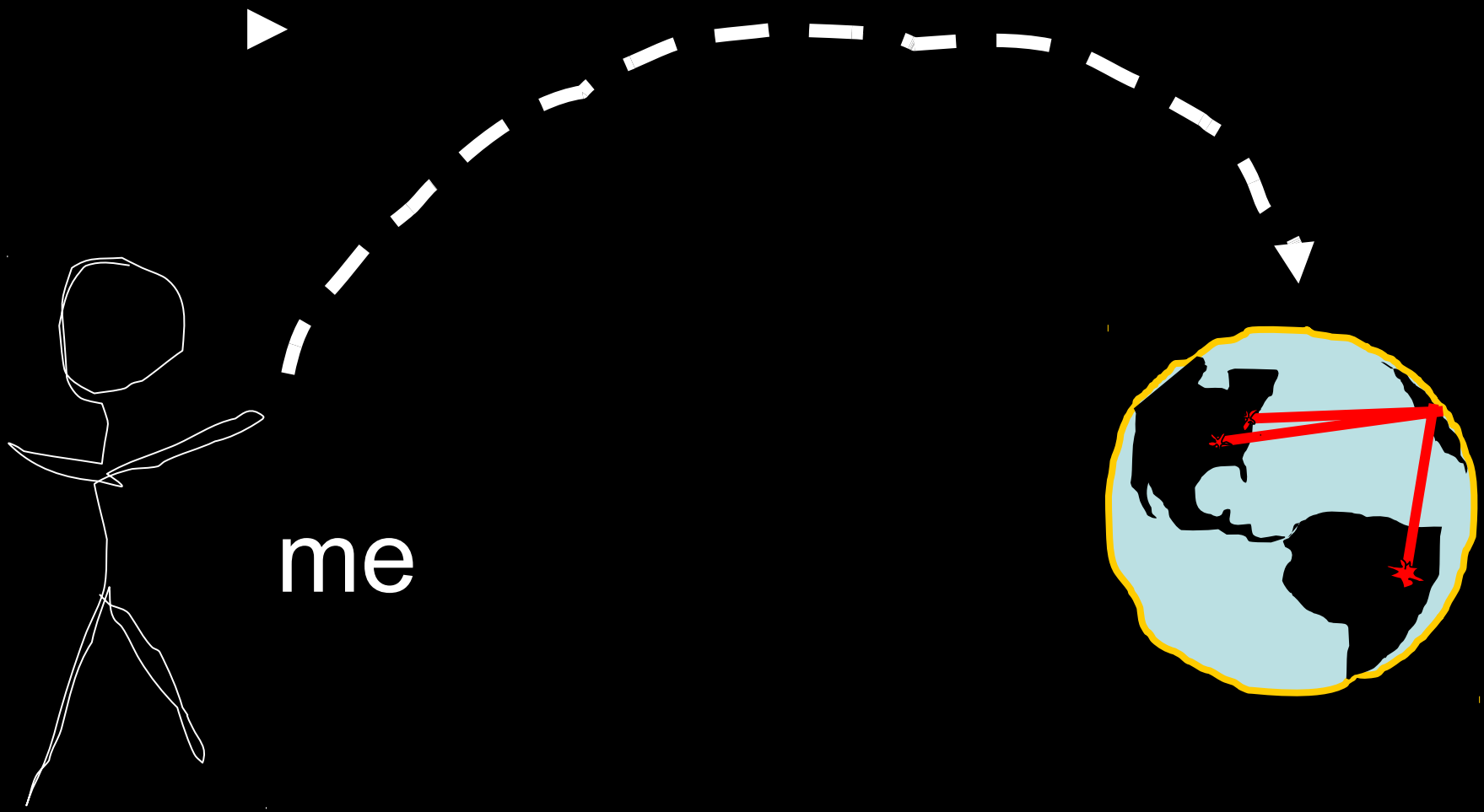
March 2011

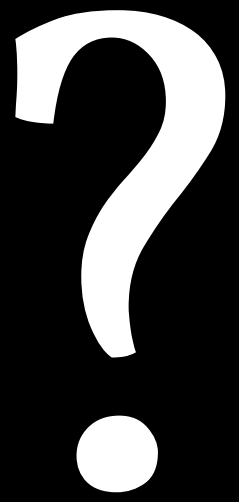
Lessons Learned From Putting Linux on System z in Production

Background: “zLinux Hans from WW will come and answer all your questions ” - *or “Did you watch up in the air?”*

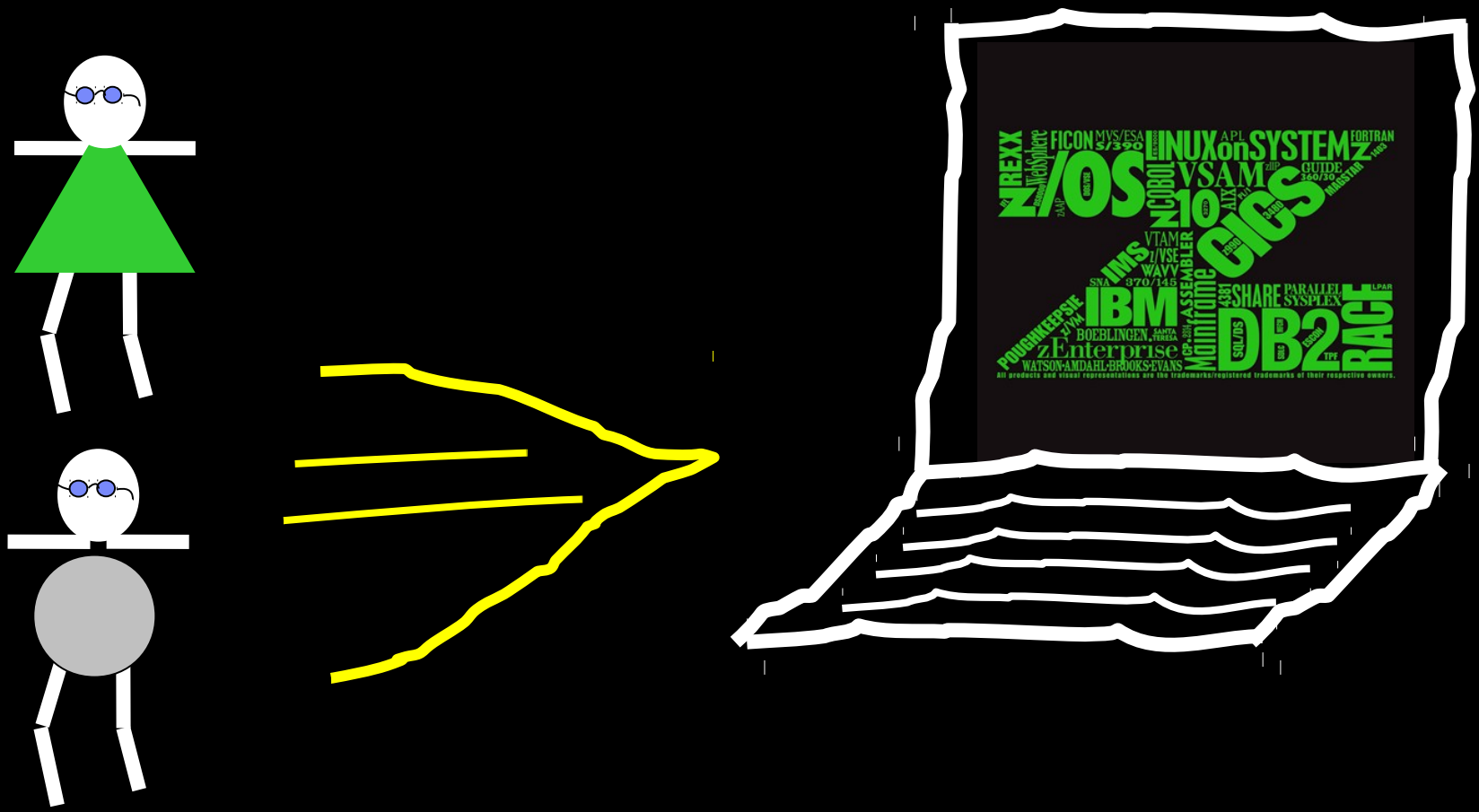


Disclaimer: More Questions than Answers

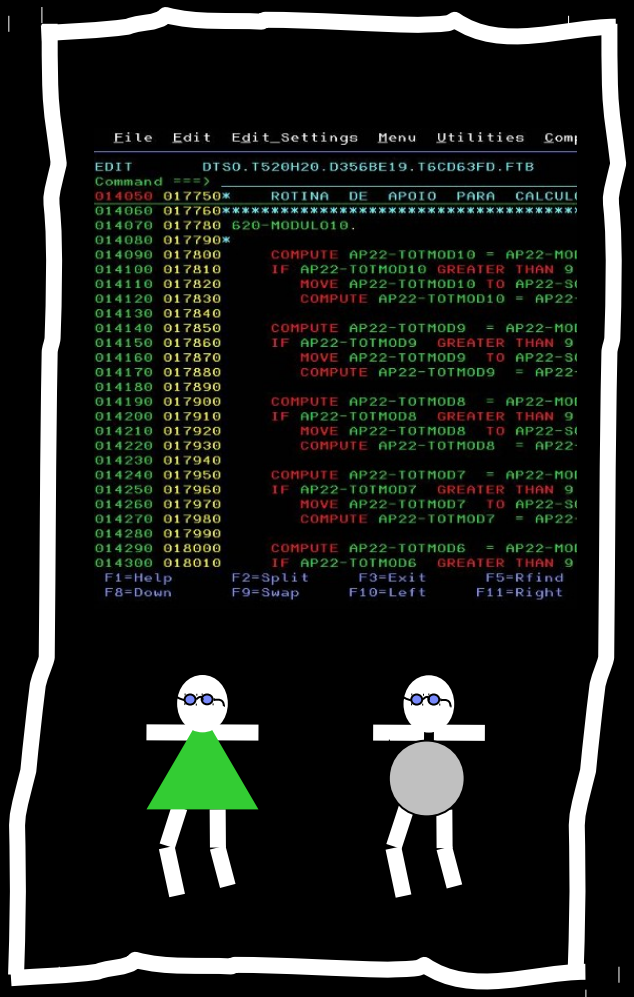
- Every site is different.
- I'm not omniscient
- I'm going to give you questions to ask back at your company
- I'll also take questions as we go along unless time gets short
- Most of the content is based on what I have seen at customers in Europe, Middle East, Africa, Asia Pacific and to a small degree in North America
- Other IBMers / clients might experience different challenges



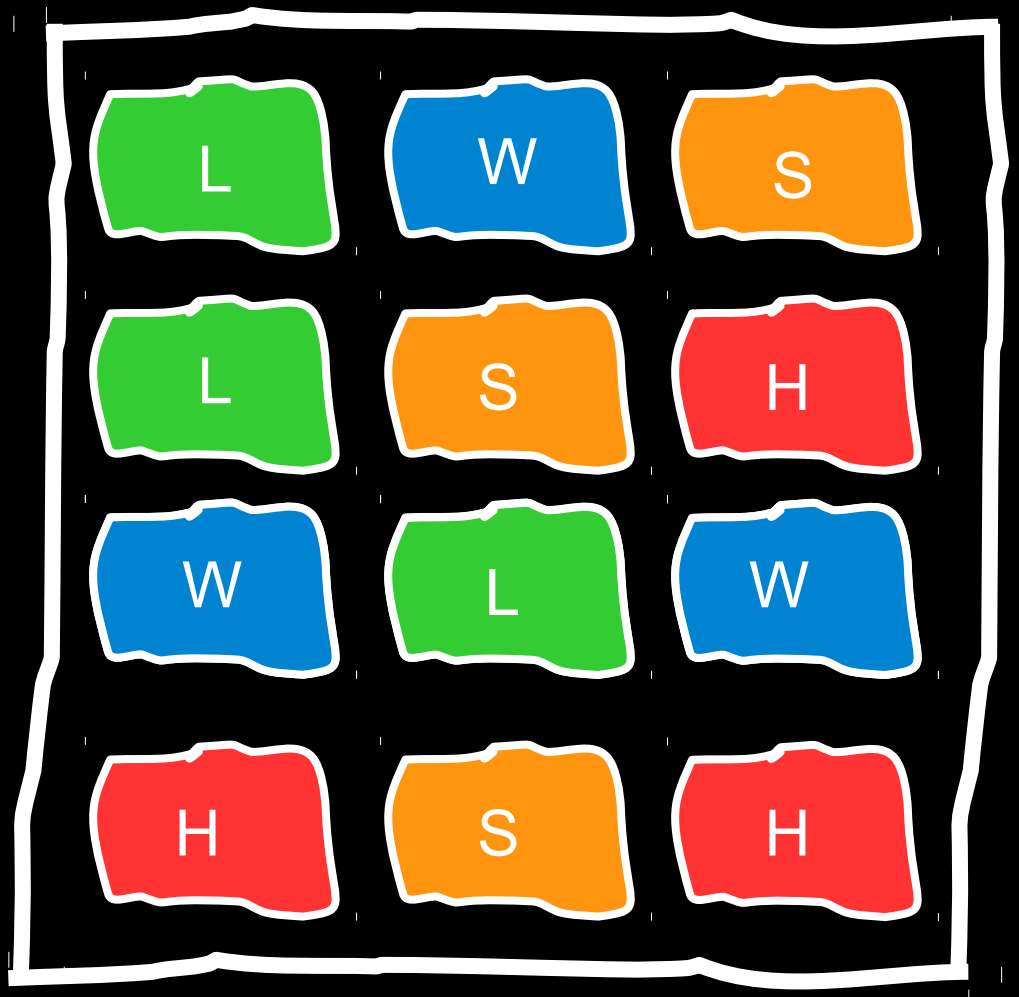
Survey: Who has not worked with Linux on System z before?



Traditional Mainframe



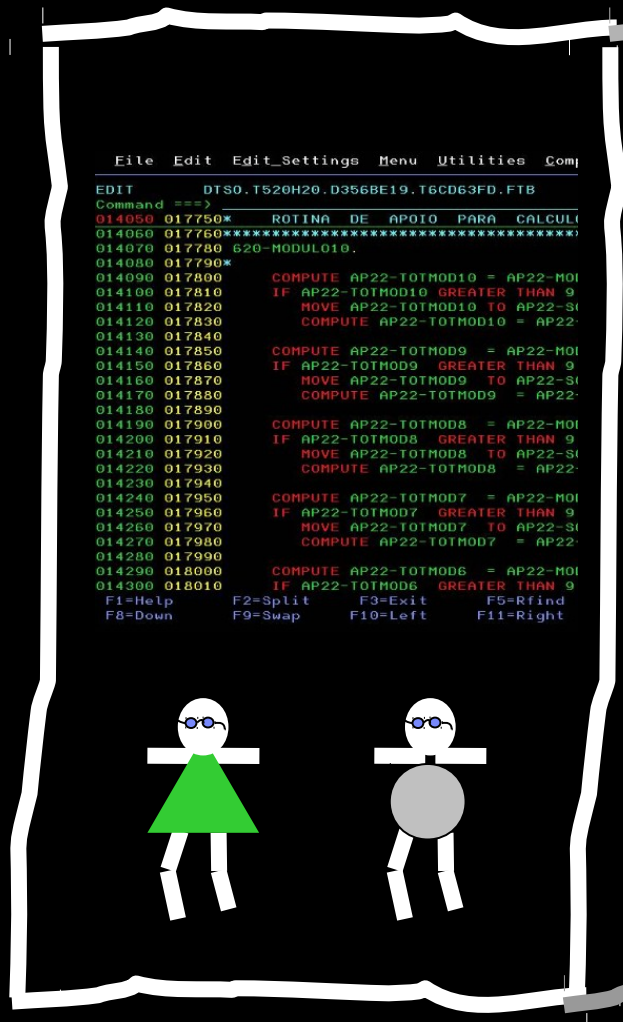
Data Center

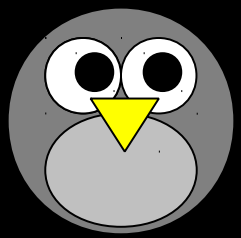


Traditional Mainframe

New Workload

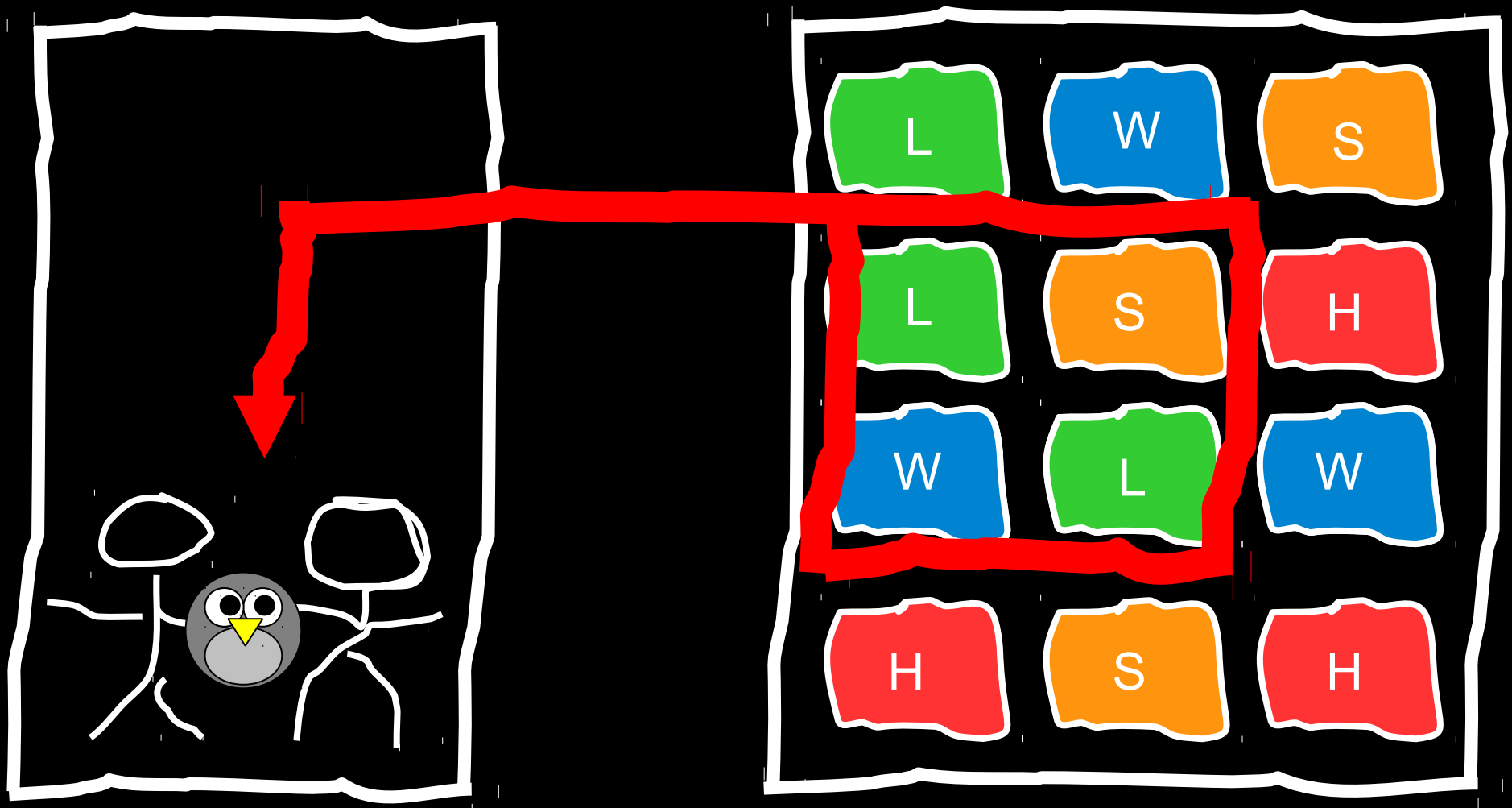
Data Center





Linux only
Mainframe

Data Center



Server Consolidation is like buying a printer


Ricoh
RICOH
Aficio
1105

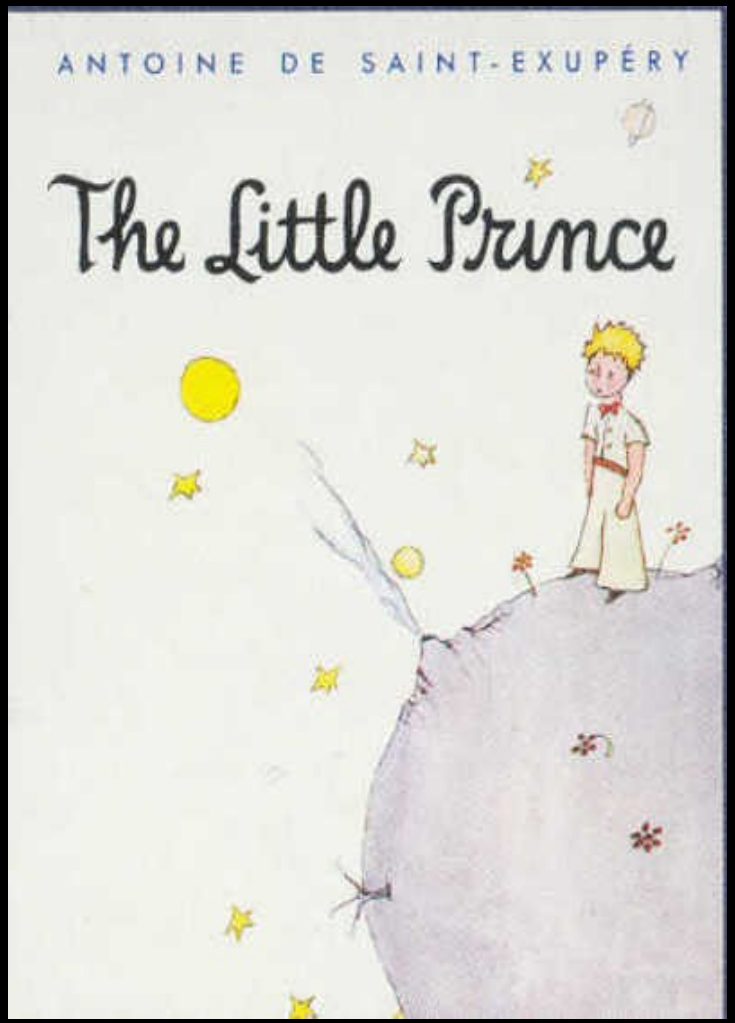
Promotion Price: $ 99

Server Consolidation is like buying a printer

Server Consolidation is like buying a printer

What you see depends on the perception...or your background

What you see depends on the perception...or your background



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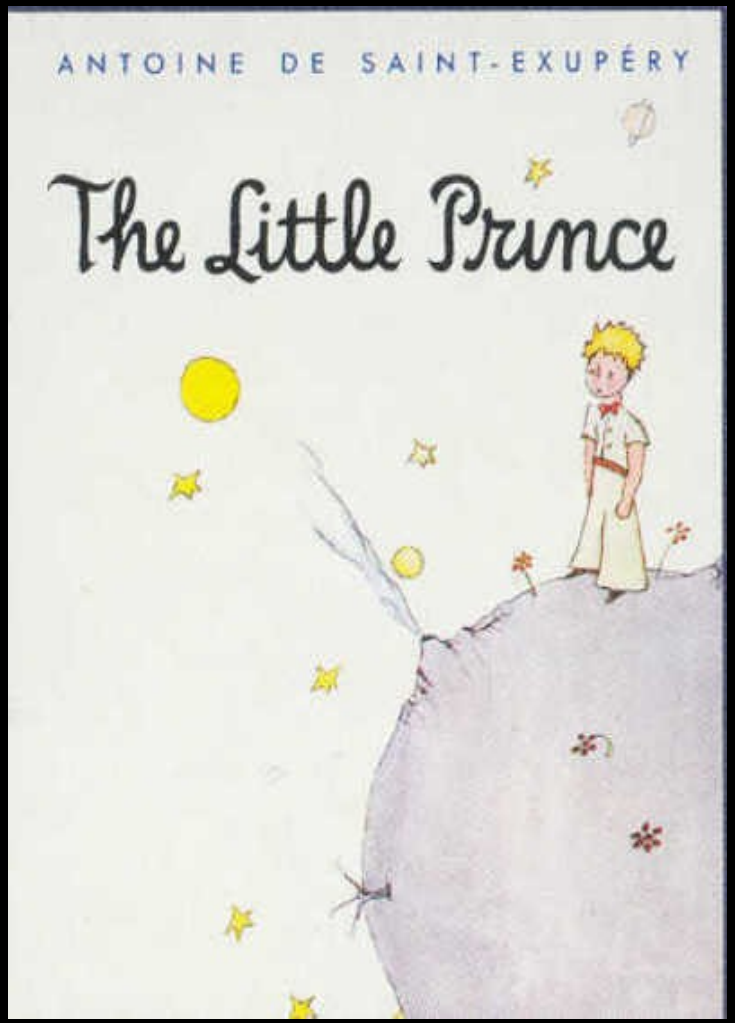

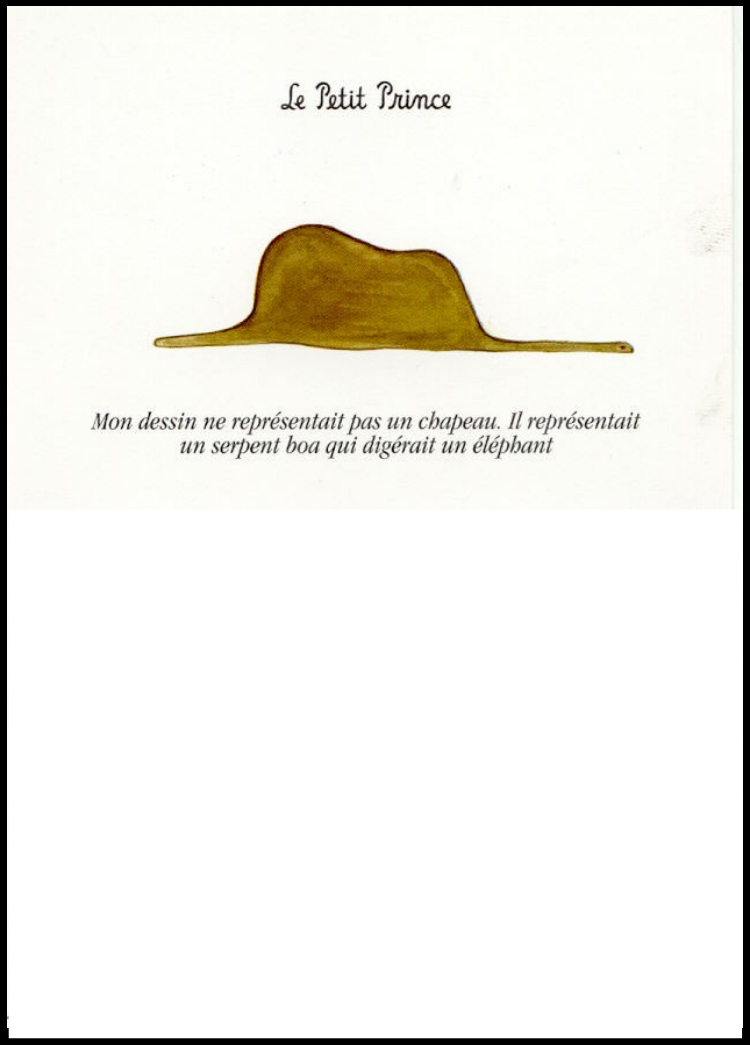

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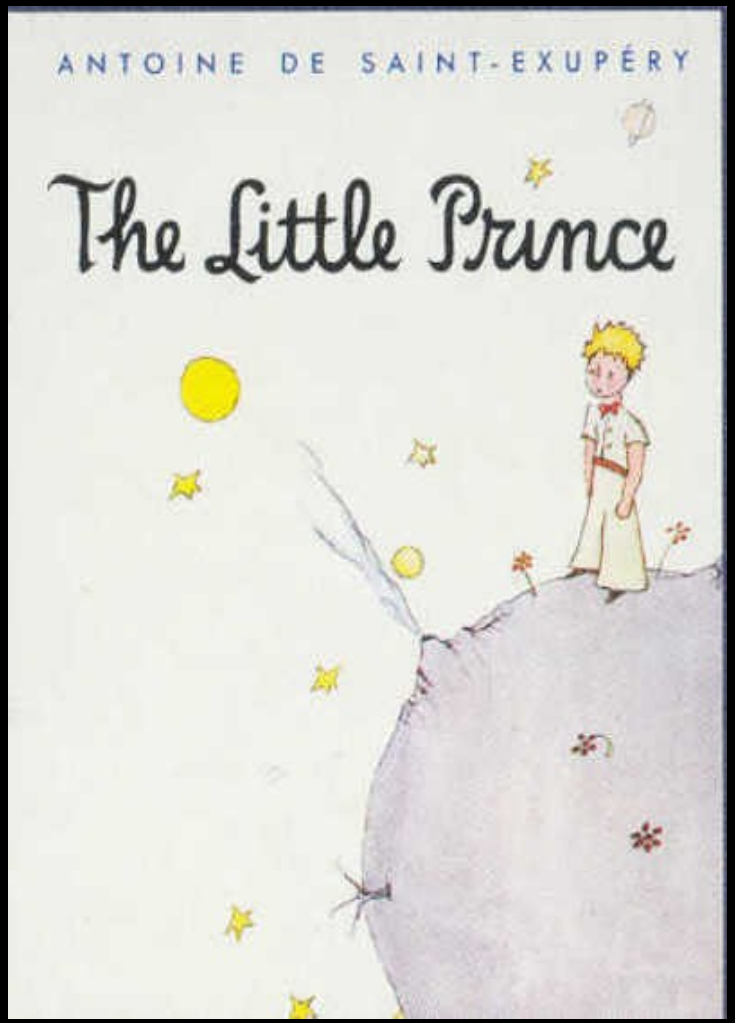
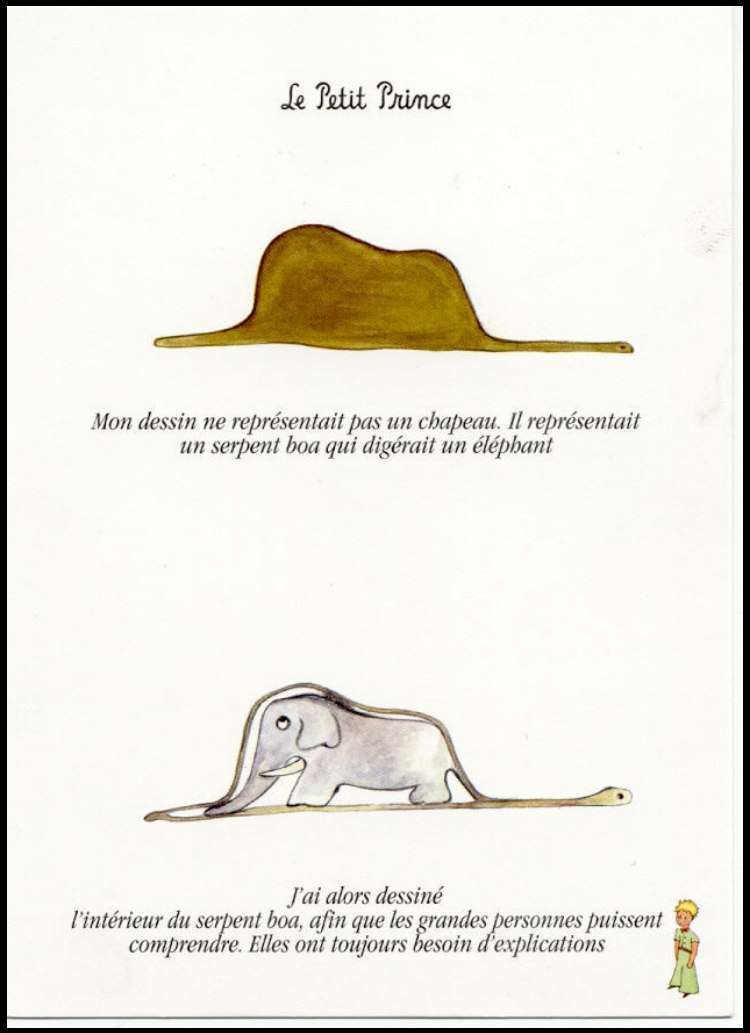




What you see depends on the perception...or your background

What you see depends on the perception...or your background

What you see depends on the perception...or your background

Do we all speak the same language?

Bill Smith
25+ years of
Mainframe experience

Alice Jones
Grew up with a
mobile phone

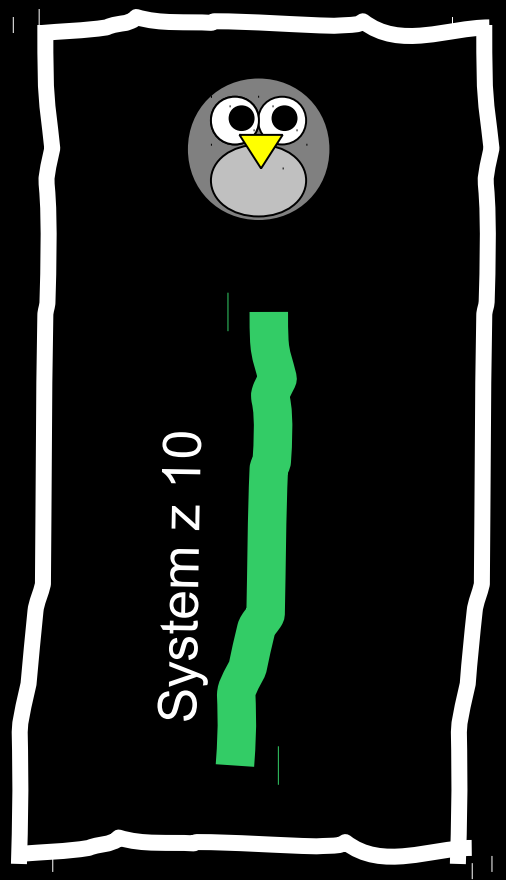
IPL
4-way
Main Storage
DASD
OSA

Multi Core
Gigabit Ethernet
Memory
SAN
....

IBM Enterprise Linux Server Offering

Linux + z/VM + z10 BC = ELS

- Standard **z10 BC Mainframe**
- Two 3.5GHz processors enabled for Linux
- 64 GB of memory
- Fibre and ethernet communications
- IBM Virtualisation z/VM including 3 years S&S
- HW maintenance for 3 years



Starting at a price of 294 k€ (312 k$)!

Incremental IFL starting at 96k€ (99 k$)!

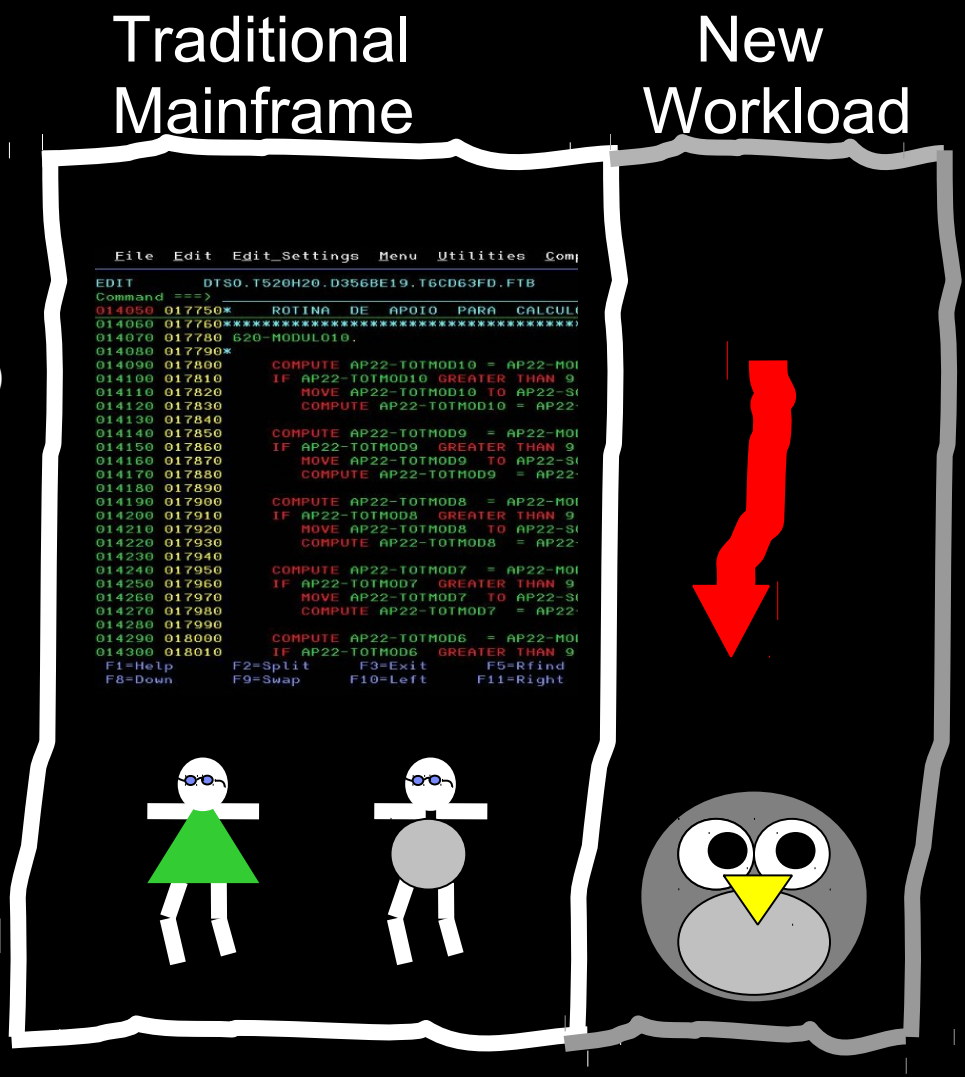
Solution Edition for Enterprise Linux Server

The System z Solution Edition for Enterprise Linux is a set of

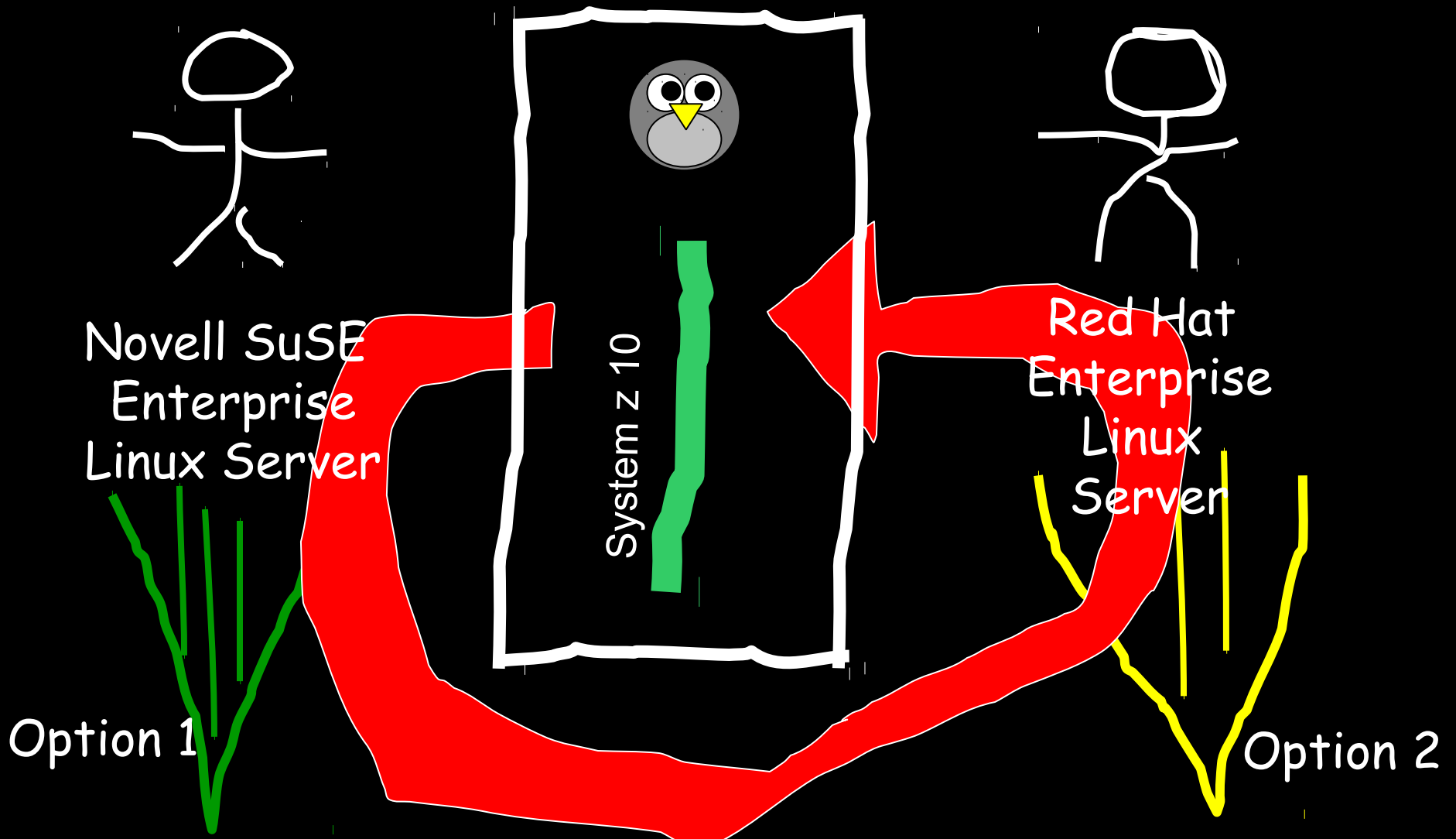
- Integrated Facility for Linux (IFL)
- processors,
- memory,
- I/O connectivity
- and z/VM virtualization software
- In flexible configurations to an existing mainframe system

For Incremental new workload

Cannot be applied to existing workload



The Linux Support is not included in these bundles



Enterprise Linux Server – Entry Configuration (real customer!)

Tangible benefits:

	Existing 4 HP Alpha Server ES45 + HP disks 4x3 CPU Alpha 21264C 9x1 core Oracle license	IBM Bladecenter H 2 HS22 w/2 proc. 4-core IBM Storwize V7000 disks 16x0.5 core Oracle license	IBM Bladecenter H 2 IBM P7 PS700 4-core IBM Storage DS5020 8x1 core Oracle DB license	IBM System z10 ELS 1 IFL IBM Storwize V7000 1 Oracle EE license
1st year	164,234	219,998	242,888	234,040
2nd year	164,234	74,234	74,234	8,248
3rd year	164,234	74,234	74,234	8,248
Total (3 years)	**€ 492,701**	**€ 368,465**	**€ 391,355**	**€ 250,537**

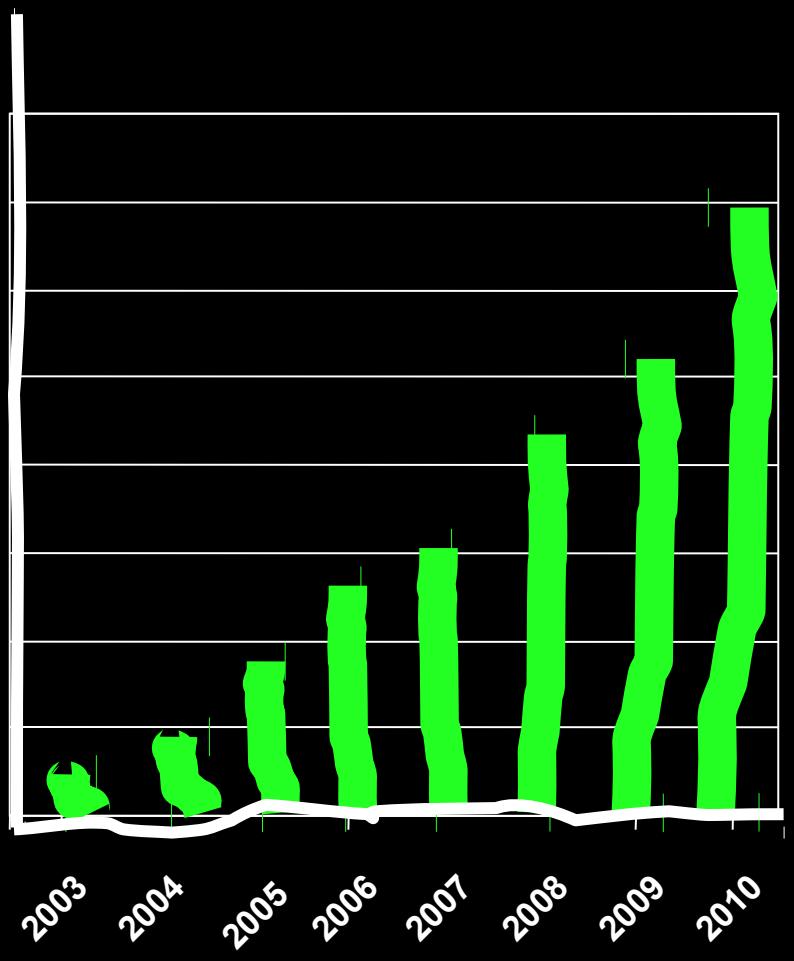
Prices based on actual European market prices (Euro). Local pricing and conditions will vary!

Intangible benefits:

Improved security – no information leak during data copy between servers
Improved availability – no network routers or switches
Highest reliability and centralized systems management

Linux on IBM System z
The momentum continues

Installed Linux MIPS



Growth 4Q09 to 4Q10:

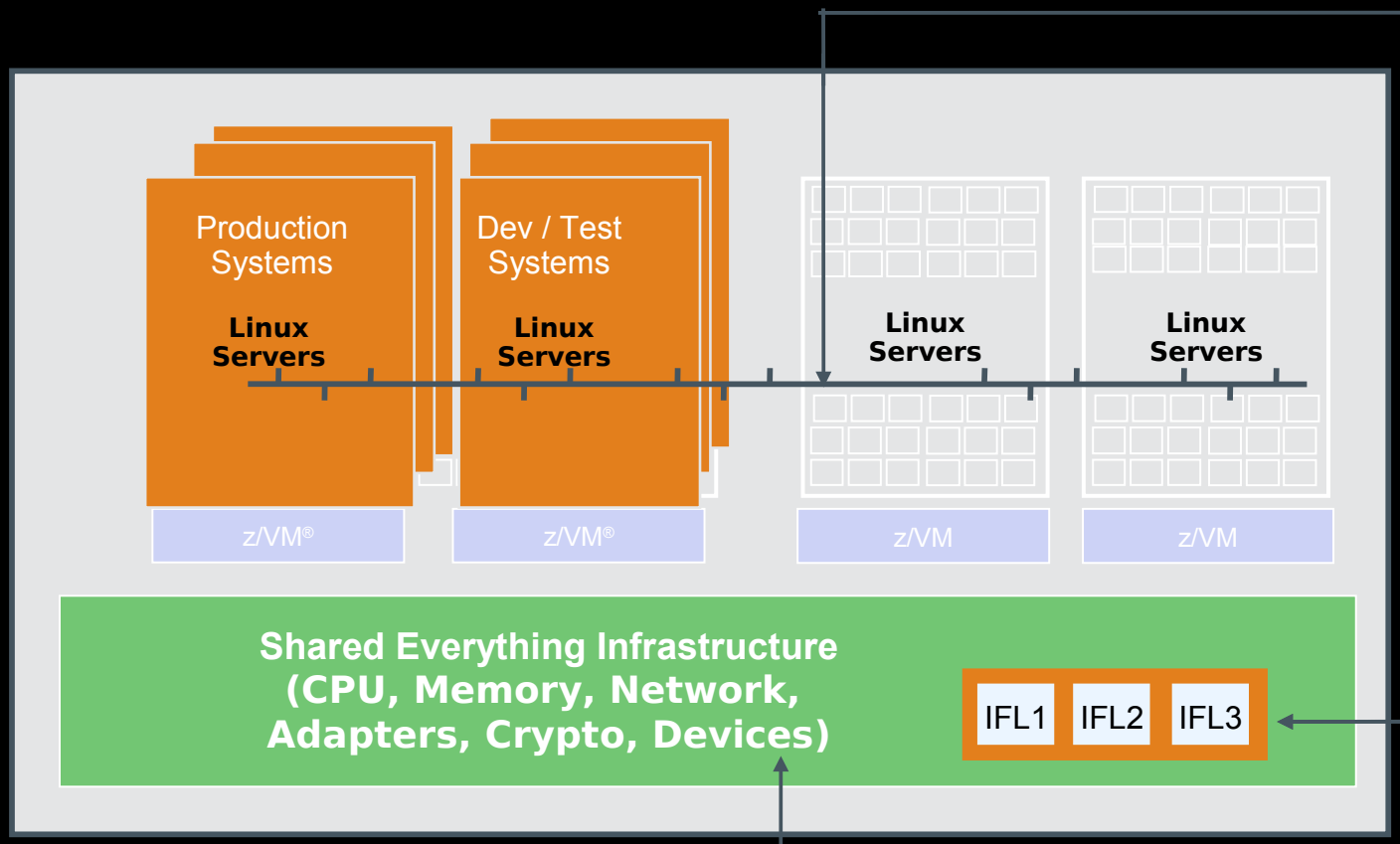
Shipped IFL volumes increased 34%

Installed IFL MIPS increased 35%

32% of System z customers have IFLs installed

64% of the Top100 System z clients are running Linux on the mainframe

The IBM Enterprise Linux Server Architecture



"Inside the box"virtual networking

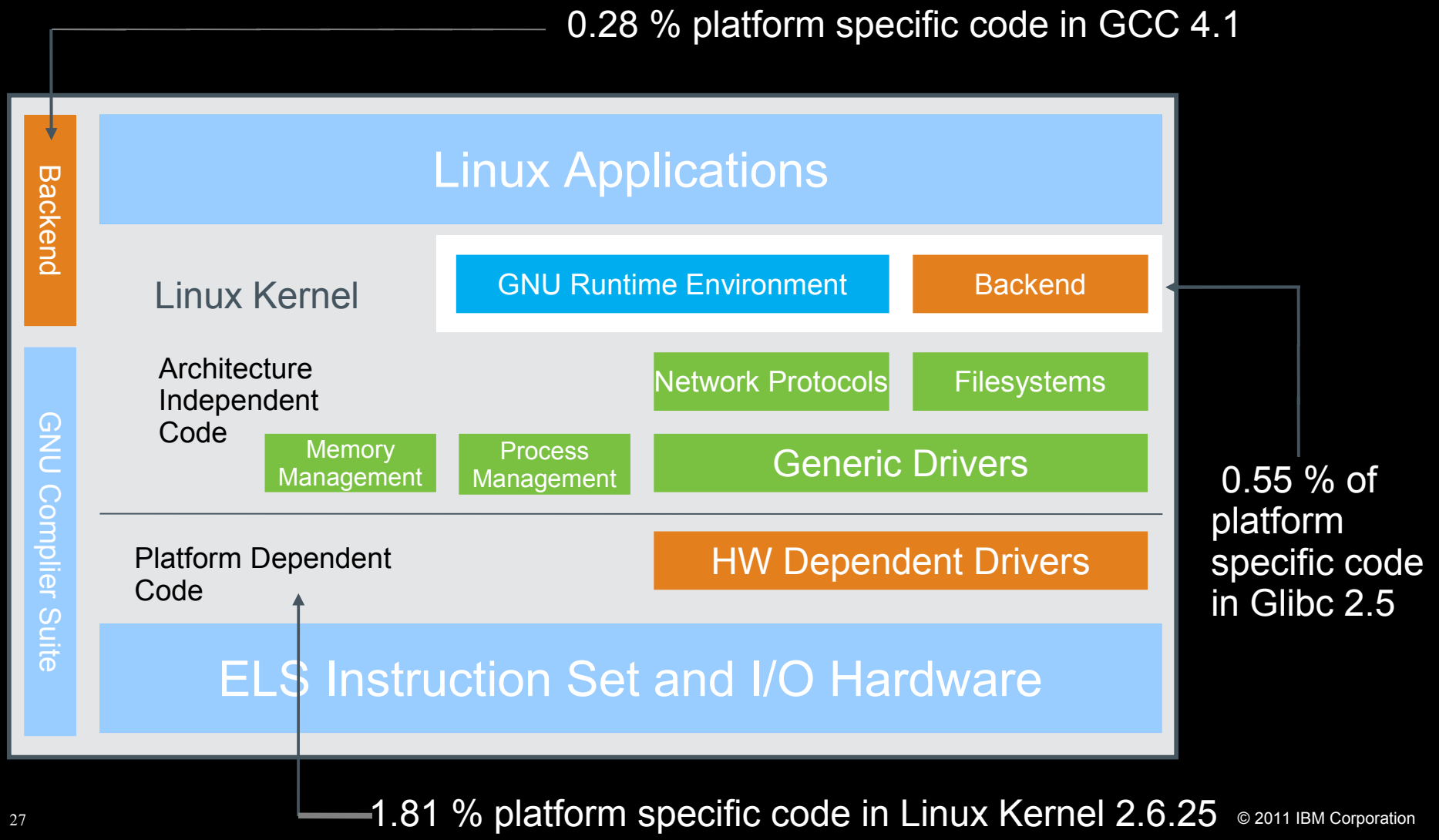
... most Linux ISV software fees are priced on real CPU capacity...

...a potential source of cost savings given z/VM's ability to overcommit CPU capacity

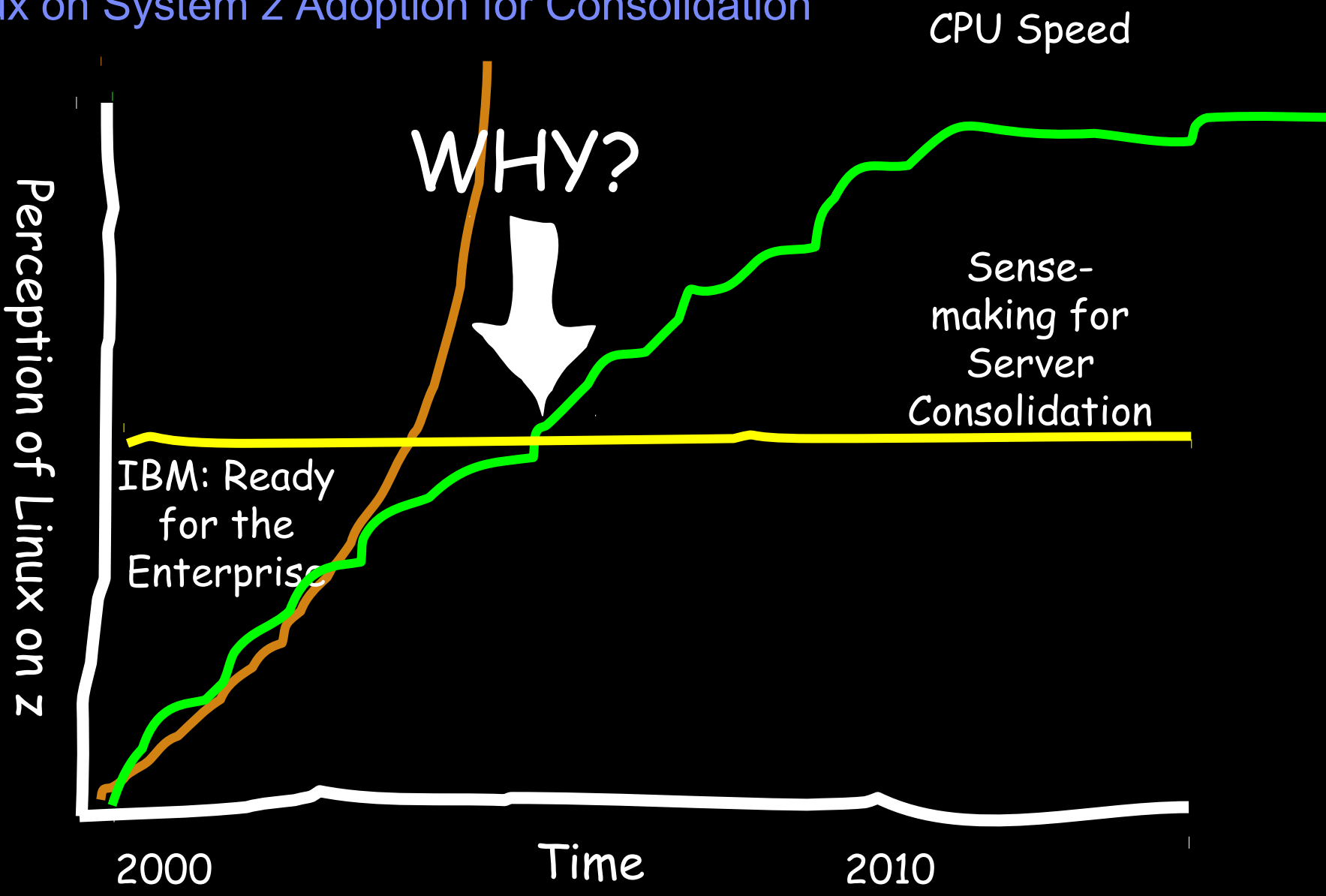
Non-disruptively scale your environment by adding hardware assets that can be shared with *every* virtual server

Structure of Linux on System z

Many Linux software packages did not require any code changes



Linux on System z Adoption for Consolidation



How Do Companies Typically Select a Platform for Their Applications?

- Their first question is:

  “Will it run there?”

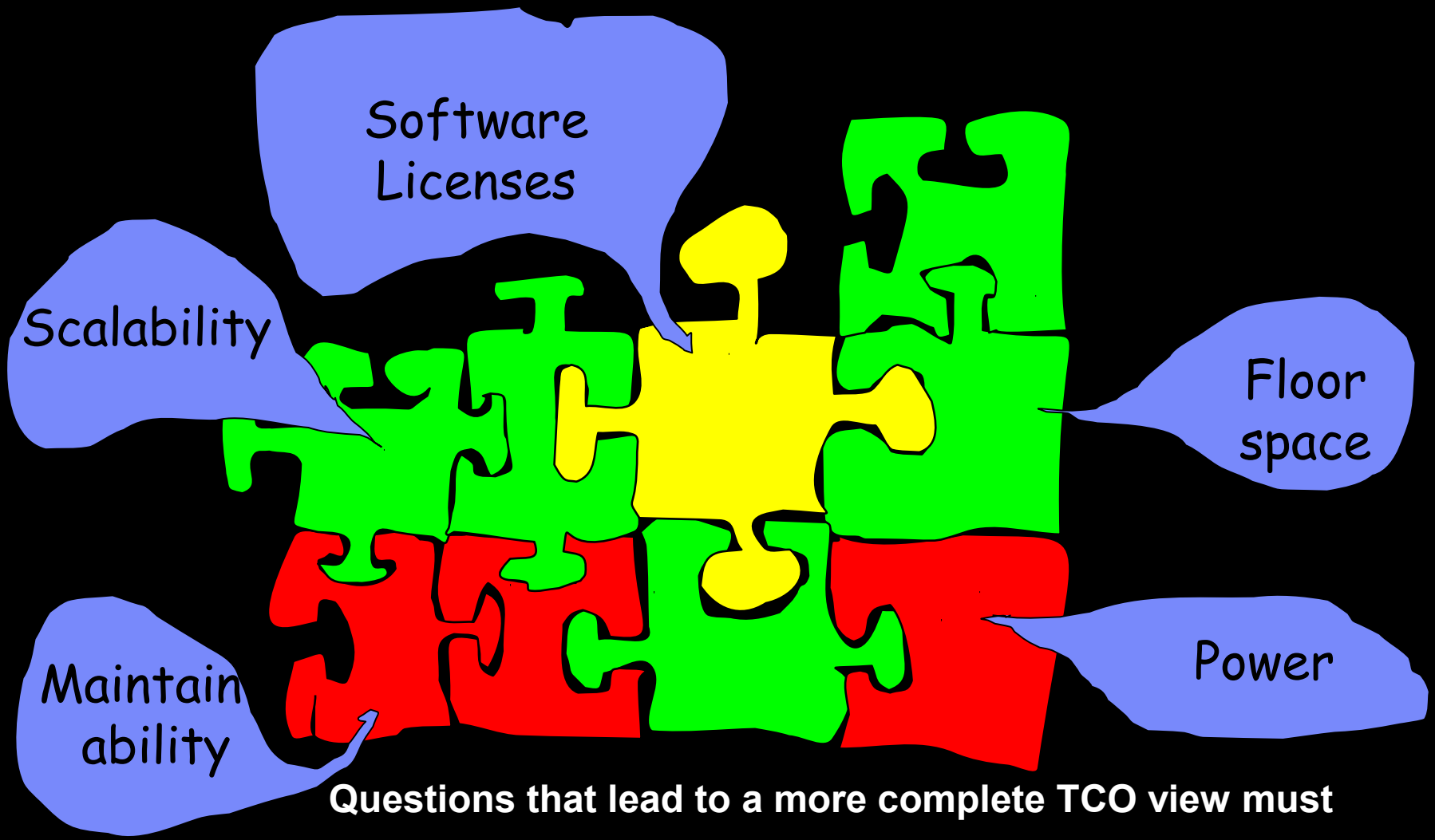
- Their second question is:

  “How much does the hardware cost?”

They’re done!

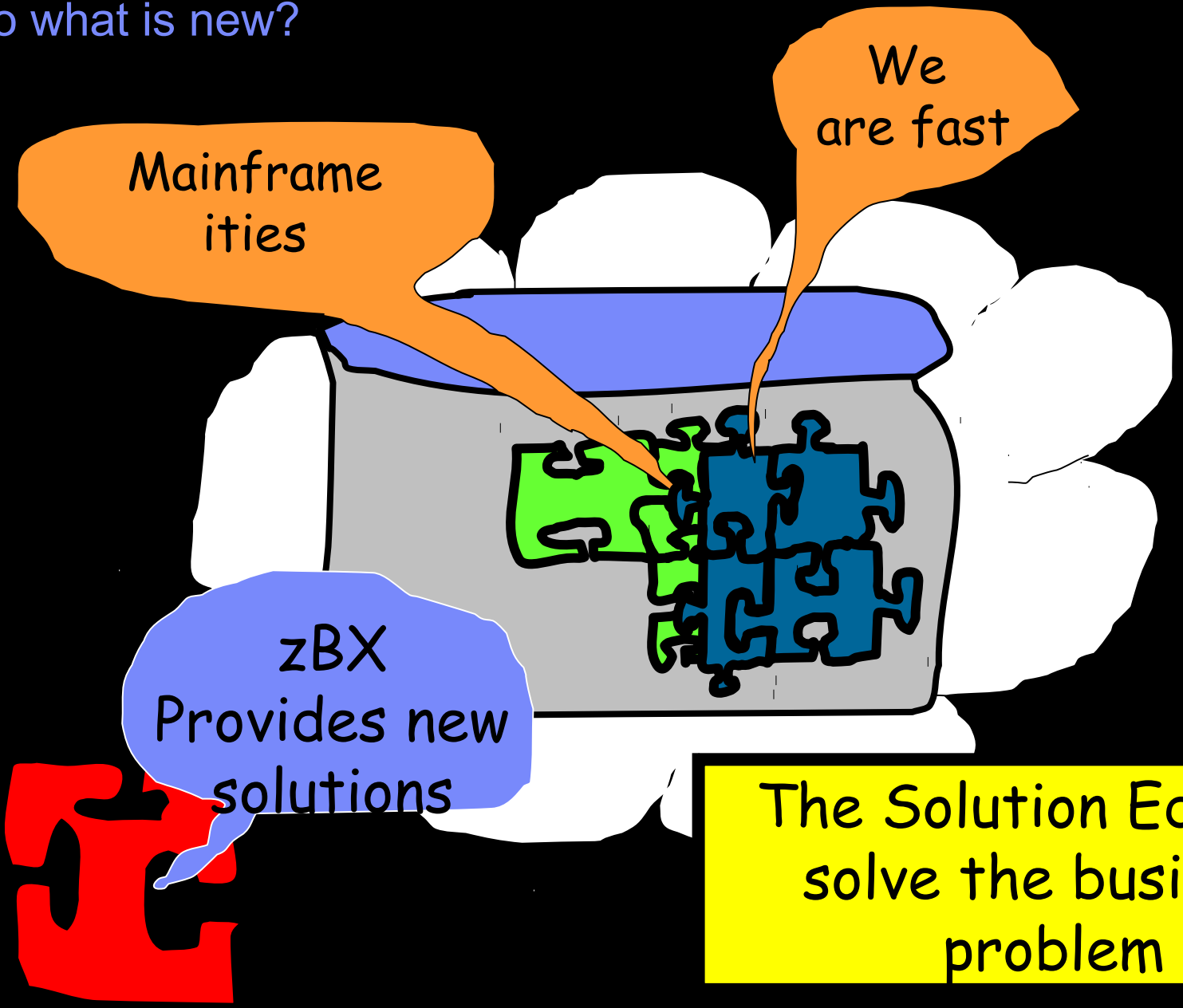
But this is just a TCA view…
Is that all they should be thinking about?

What Did We Miss?
Nonfunctional Requirements



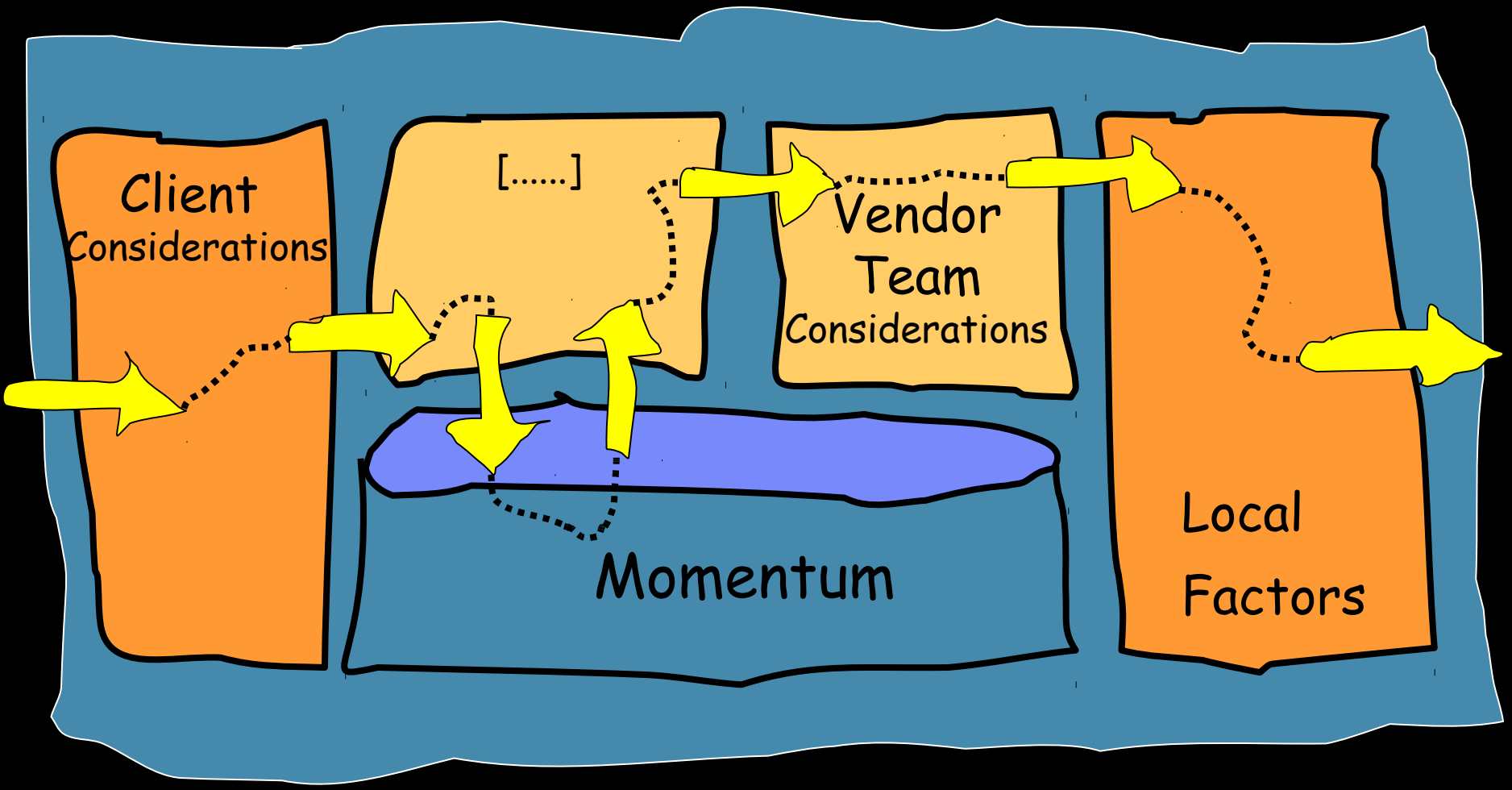
Questions that lead to a more complete TCO view must be considered…

So what is new?

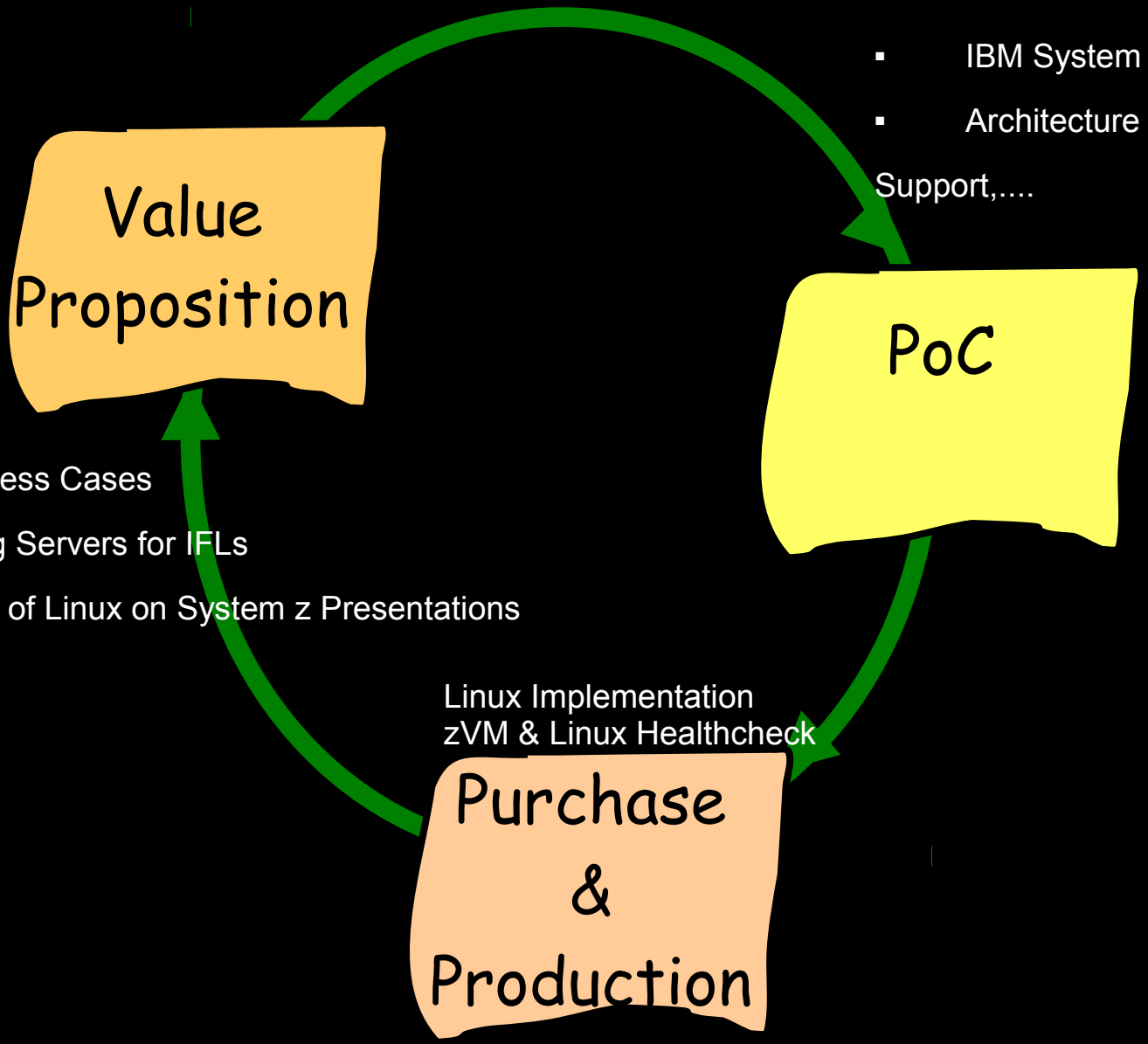


The Solution Editions solve the business problem

A myriad of factors influence platform selection



If we simplify it a little bit....

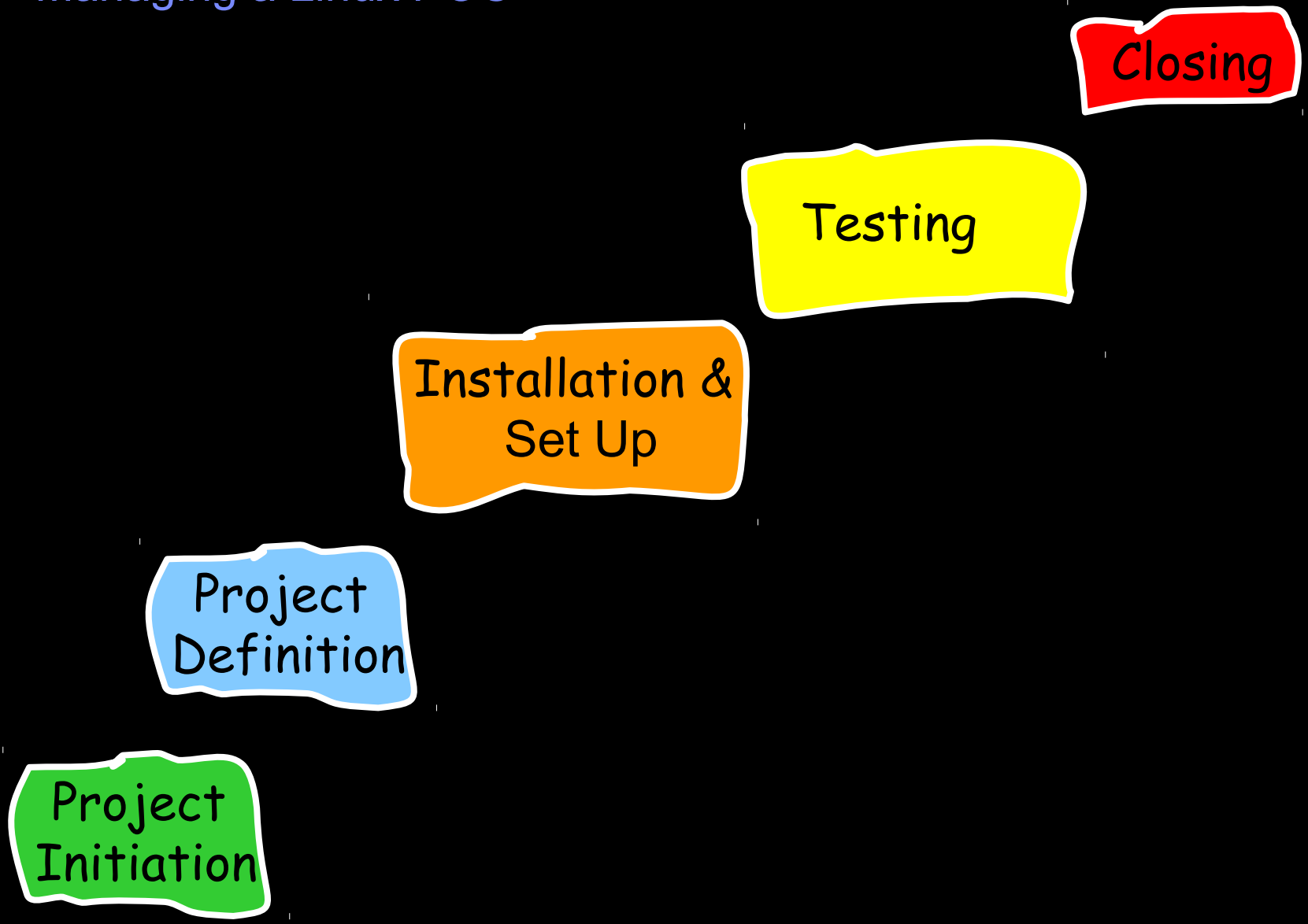


- IBM System z HW Loaner Progra
- Architecture & Installation

Support,....

- Business Cases
- Sizing Servers for IFLs
- Value of Linux on System z Presentations
- ...

Managing a Linux POC



Managing a Linux POC

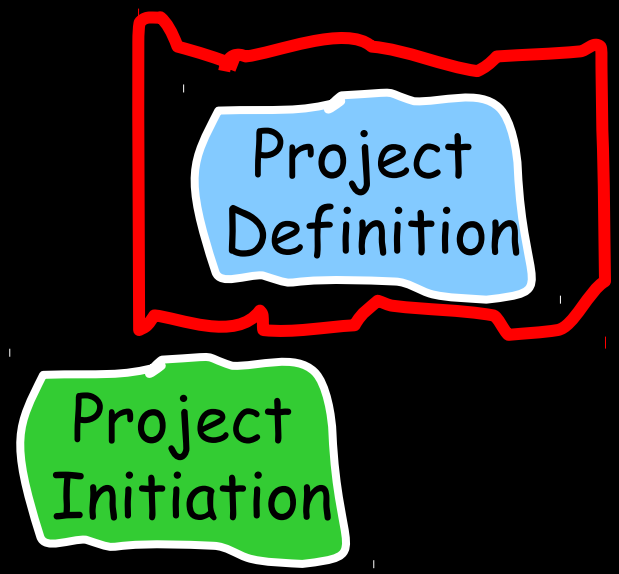
Value Proposition

- Learning the value of System z Linux
- Server Consolidation
- Sizings
- Business Case Development

POC Initiative

- Scoping POC
- POC IFL Sizings
- Real memory sizing
- Scope Document
- Statement of Work

Managing a Linux POC



Infrastructure Planning

- Hardware
- Software
- Network
- Security
- Disk
- Backup & Recovery

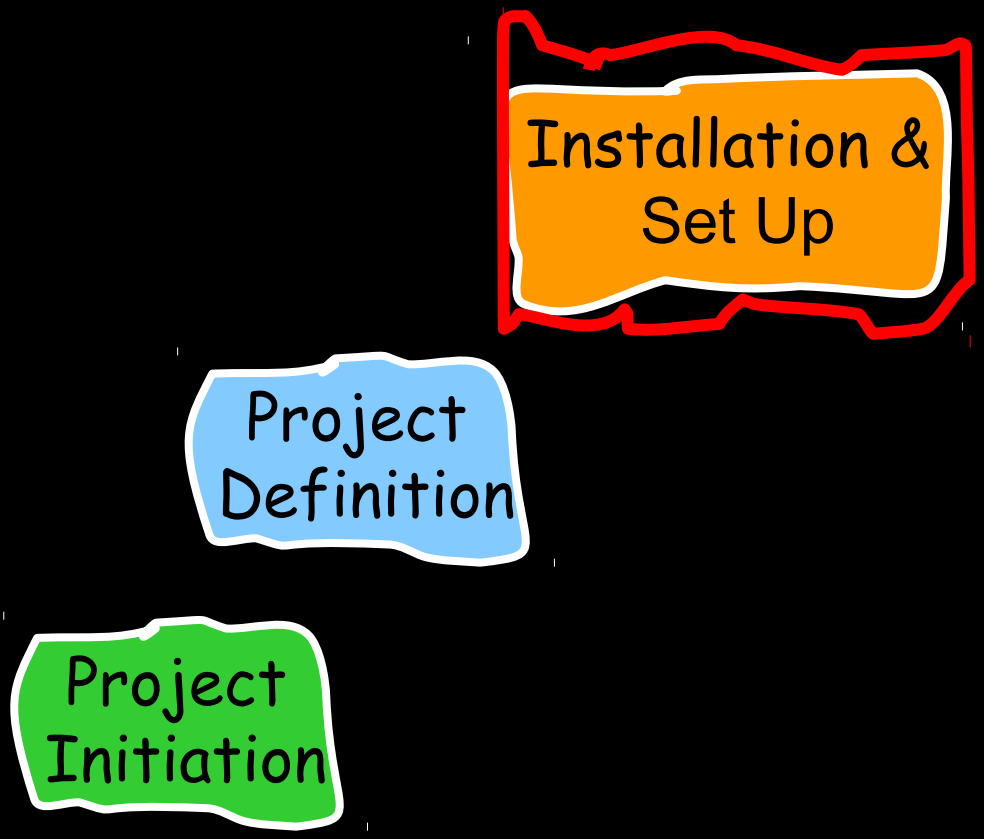
Project Planning

- Scope Document
- Project Plan
- Systems Assurance
- Statement of Work
- Status Report
- Phone / Email Support

IBM Loaner Program

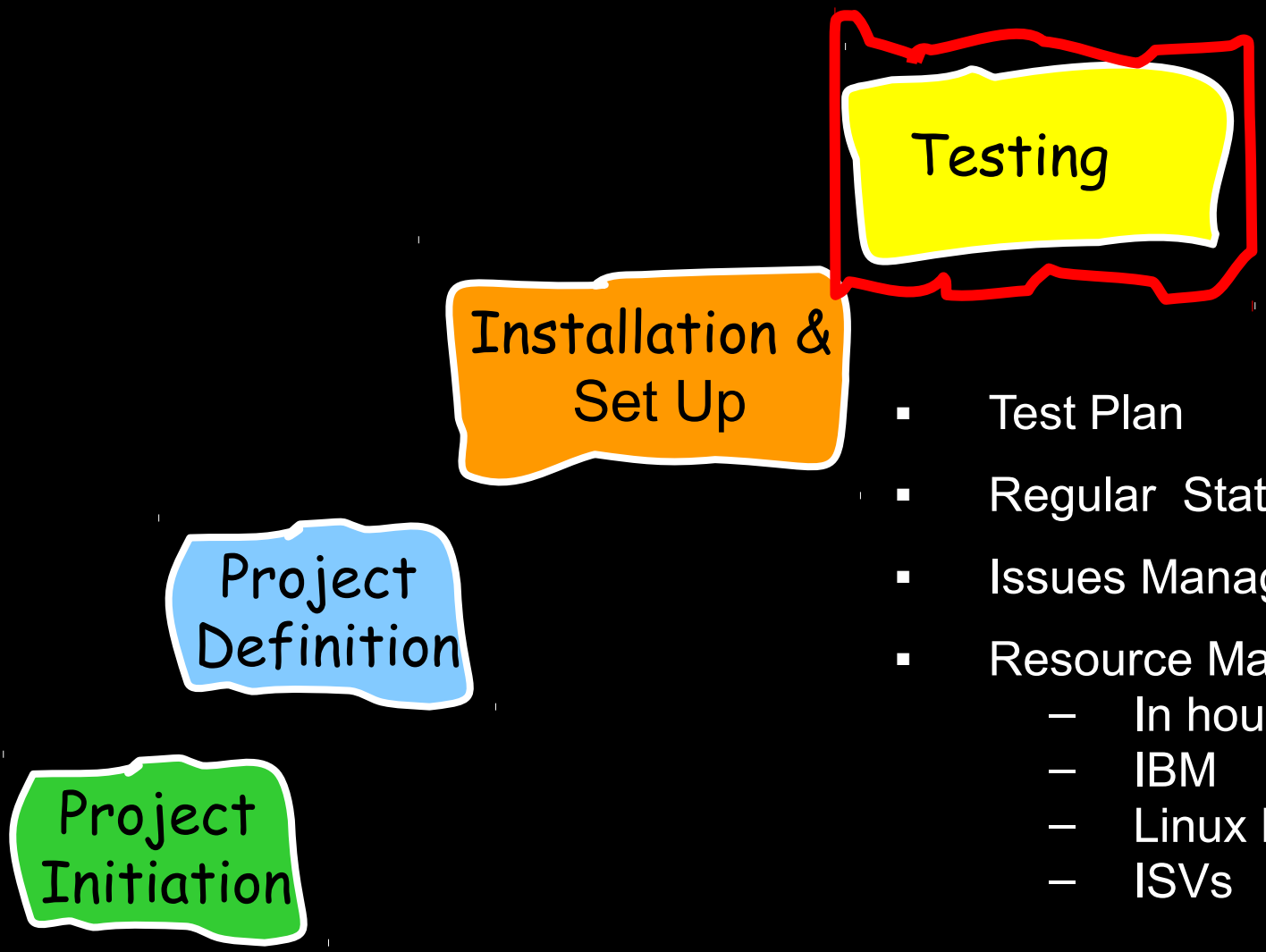
- POR date
- Success Criteria
- Configs
- Sizings
- IBM Contracts
- Linux Eval
- Software Evals

Managing a Linux POC



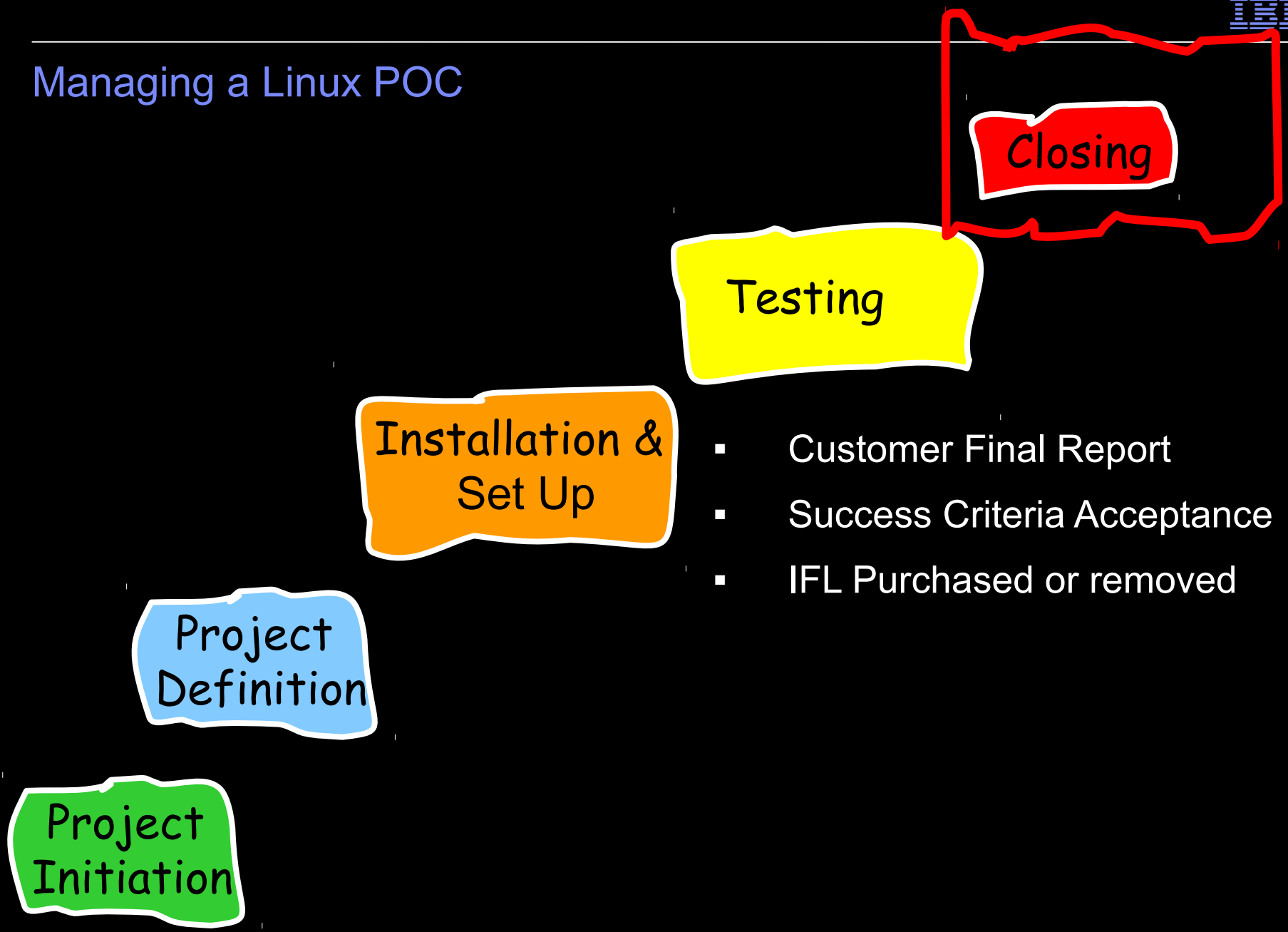
- IBM loaner Eq.
- zVM & Linux install
- Other SW install
- Network
- Security
- Disk
- DB loads
- Application set up
- Other Distributed Servers
- Regular Status Meeting & Report

Managing a Linux POC



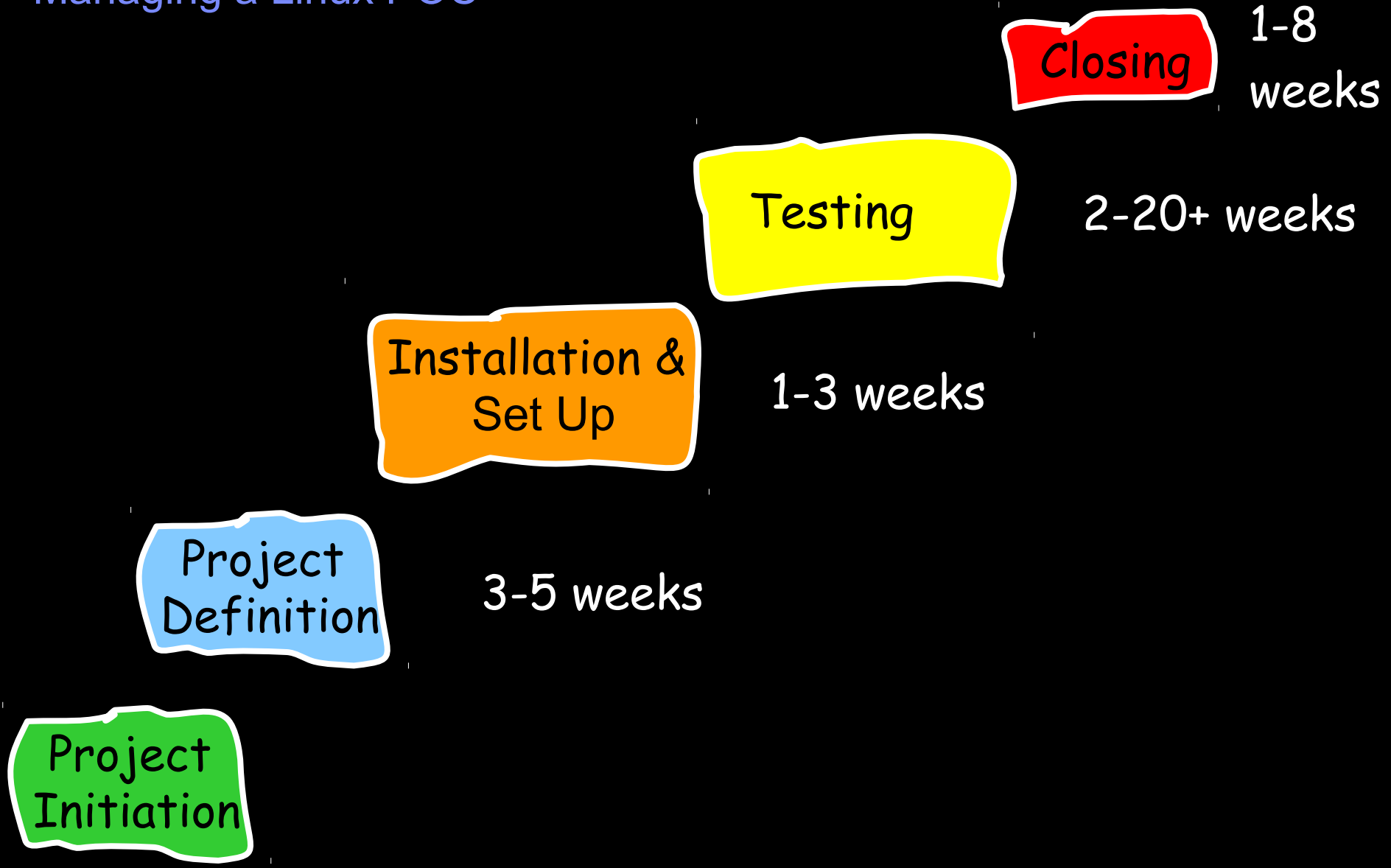
- Test Plan
- Regular Status Mtg & Report
- Issues Management
- Resource Management
  - In house
  - IBM
  - Linux Distro
  - ISVs

Managing a Linux POC

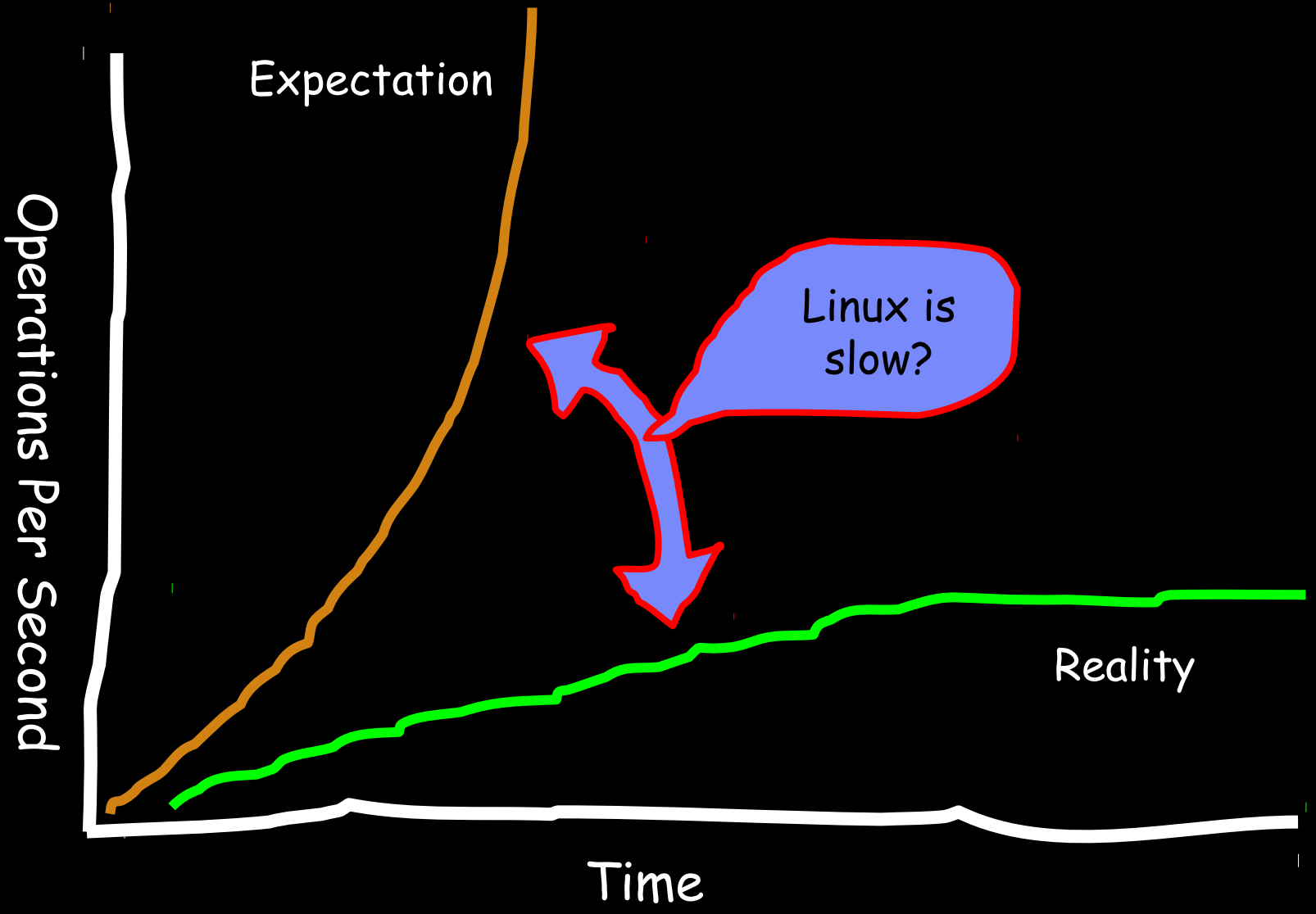


- Customer Final Report
- Success Criteria Acceptance
- IFL Purchased or removed

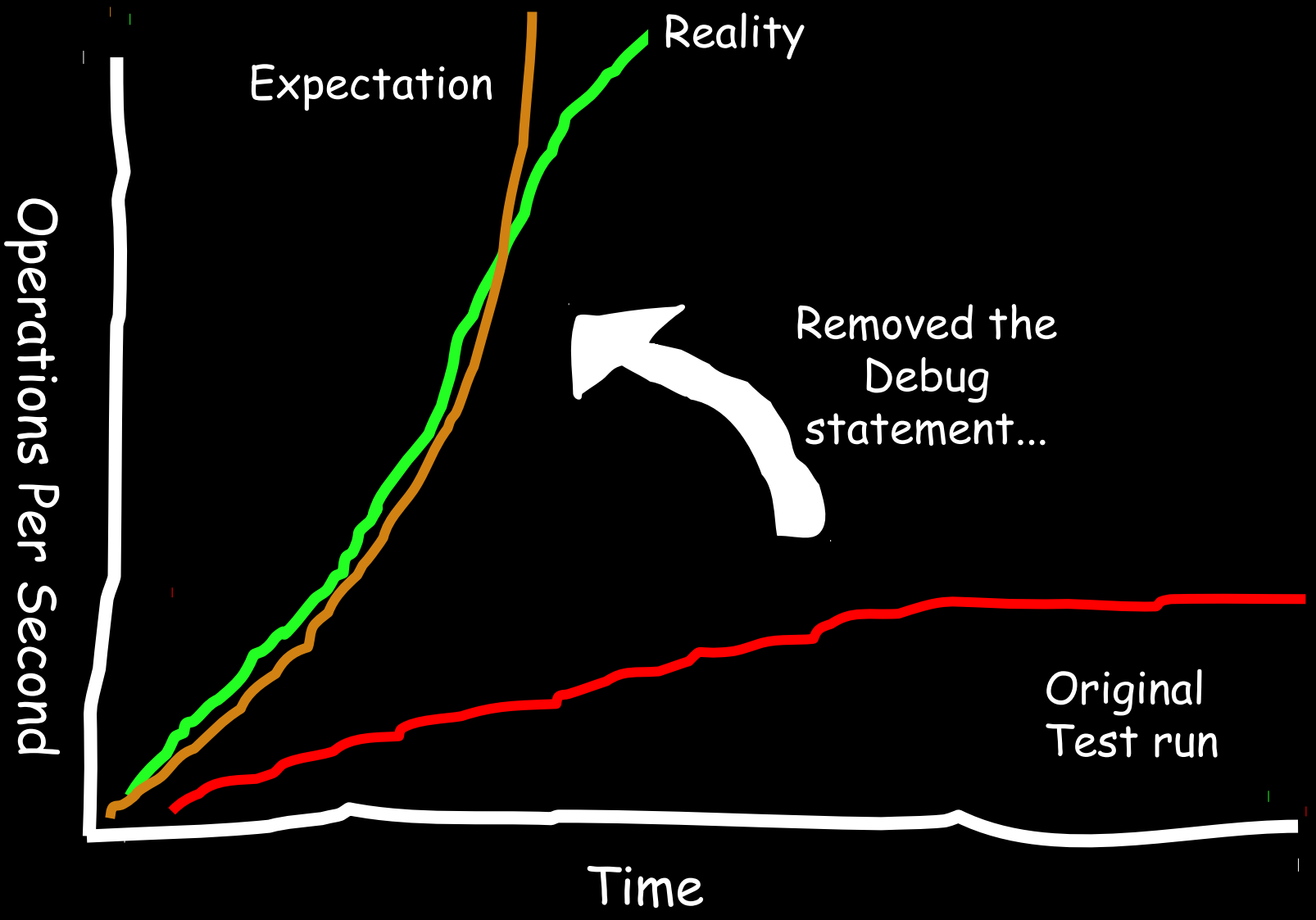
Managing a Linux POC



Example: Runtime Performance



Example: Runtime Performance

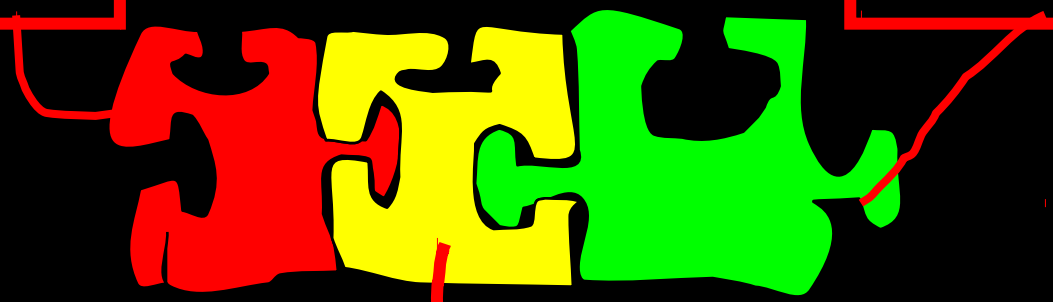


Choosing the Scope is **Critical**

Planing

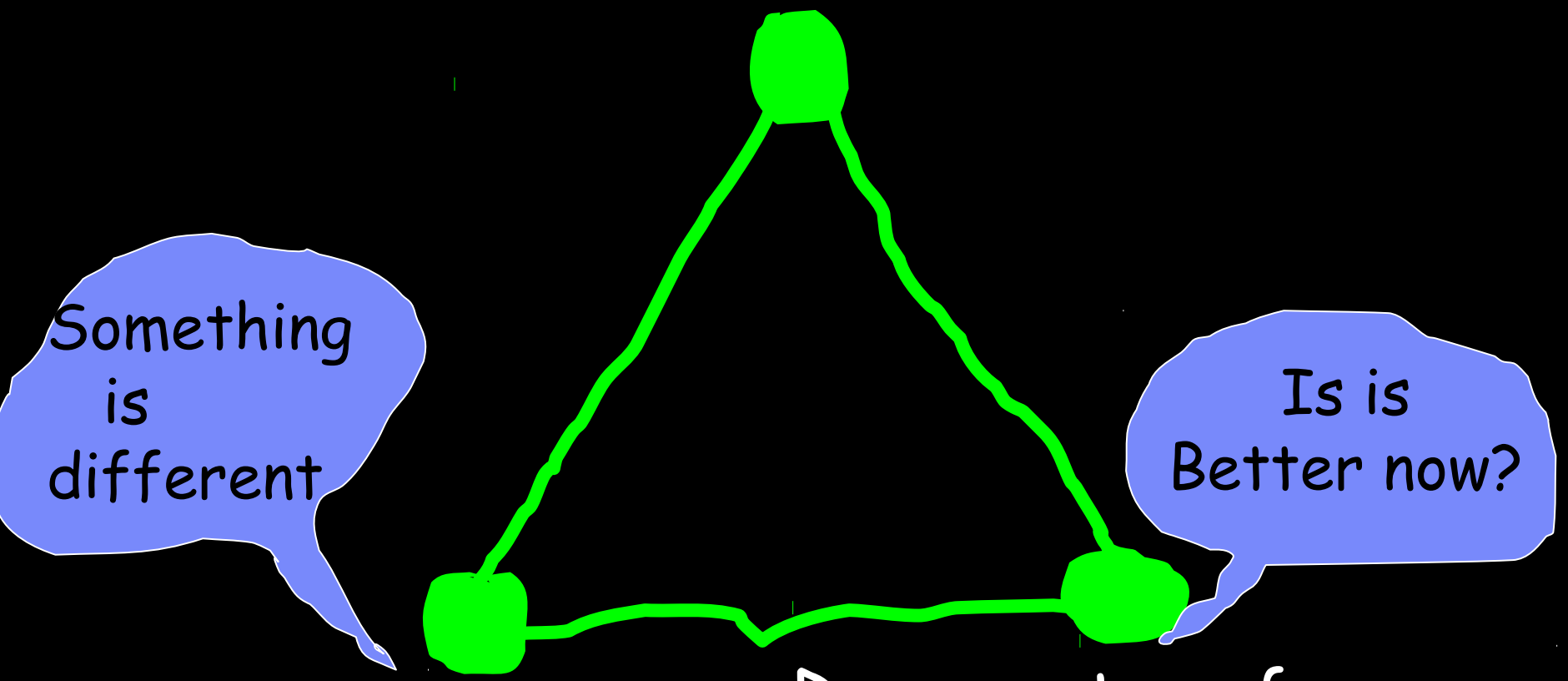
Resource Commitment

Success Criteria



Senior Management Commitment

Test Plan
& Outline tests

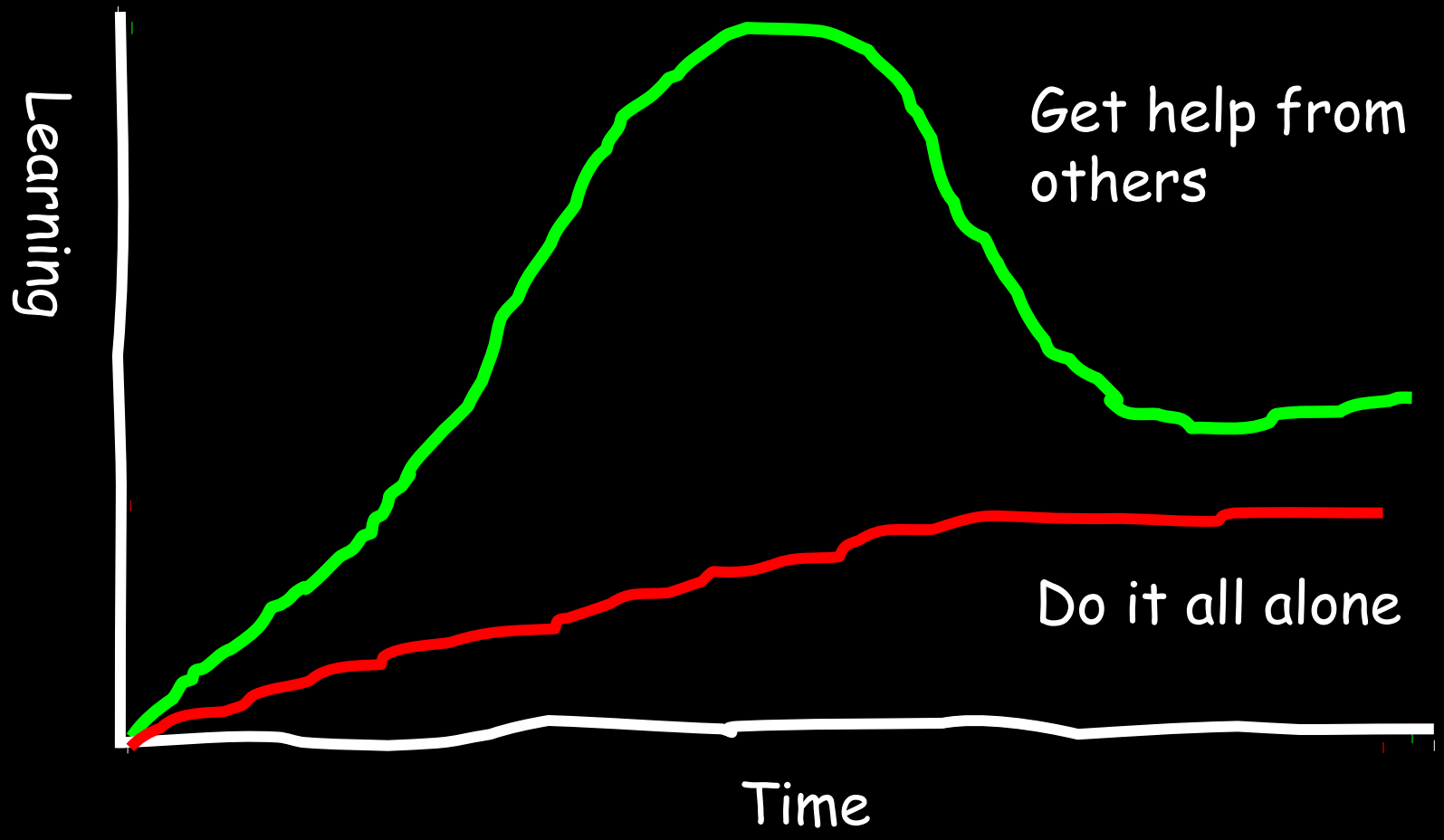


Keep track of Each run's changes & results

Document performance targets when compared to current

Learning Curve: Ask for help early

- Leverage IBM and BP resources
- Open problems with software vendors too, i.e. Oracle, RedHat or Novell



Beware of a single Benchmark POC

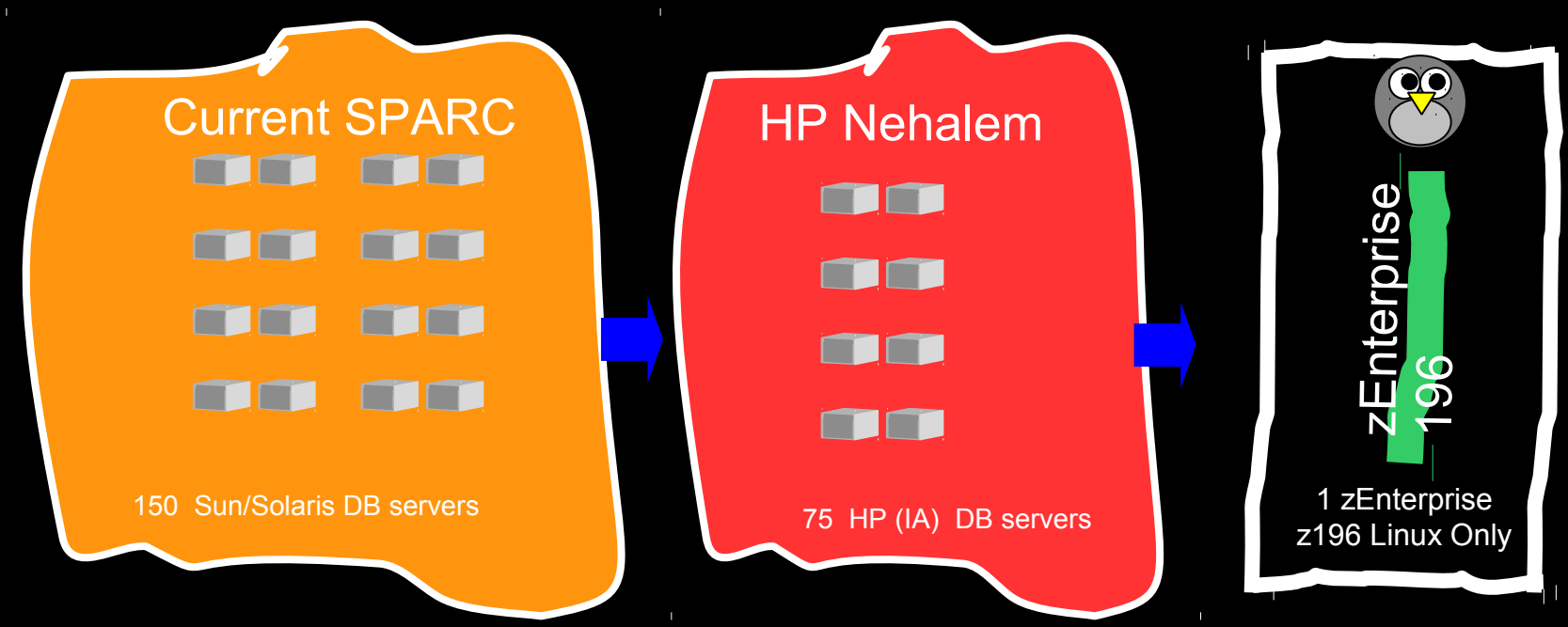
Stay away from performance benchmark tests that drive the IFL to 100% to determine maximum transactions compared to Intel/Power platforms.

Linux on System z “sweet spot” is as a multi-tasker.

A simple core to core comparison might not be the right approach

I know in the past we had to say this because our CPU was slow – now this is no longer the case

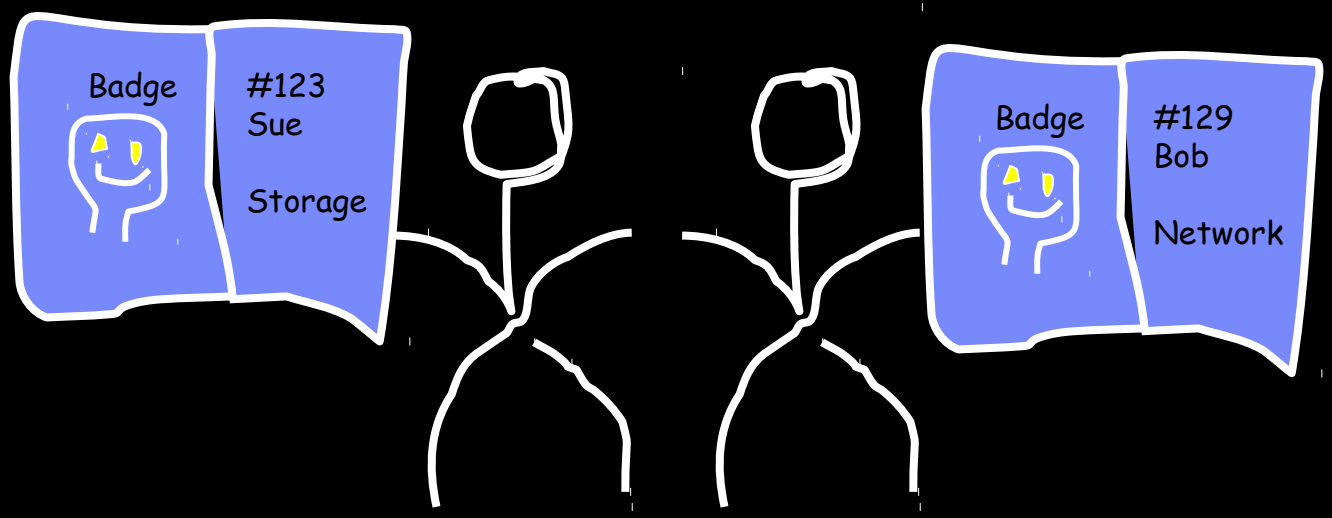
One Box is Enough



The reasons are compelling especially when Software which is licensed by the core is used!

Installation Planning: First Things First

Get the right groups involved upfront



Network
Hardware
Architects
Administrators
Storage
Security

(including network security)

Installation Planning: First Things First

Doing anything else might get you in trouble

Installation Planning: First Things First

- Installing Linux is not like installing z/OS or z/VM (hopefully you're not surprised)
- For mainframe installs, you will need an installation server
- It's "best" if this is a Linux or UNIX system
- There must be a usable TCP/IP network connection between the installation server and your target system
- This means end-to-end, through whatever firewalls, routers, bridges, WAN links, whatever

Disk Storage Selection

- What kind of disk/DASD devices are you going to be using?
  - Directly attached (FICON or ESCON)
  - SCSI over FCP
  - iSCSI
  - SAN
  - NAS

- SCSI over FCP gives better performance, and the SAN adapters are cheaper, but you might need additional adapters on the mainframe side. (Can be used for FICON or FCP, but not both at the same time.)
- Make sure that your storage hardware is certified/compatible with z/VM & Linux on System z?
- Who do you need to work with to make that work correctly?

Don't turn a PoC into a Production Environment!

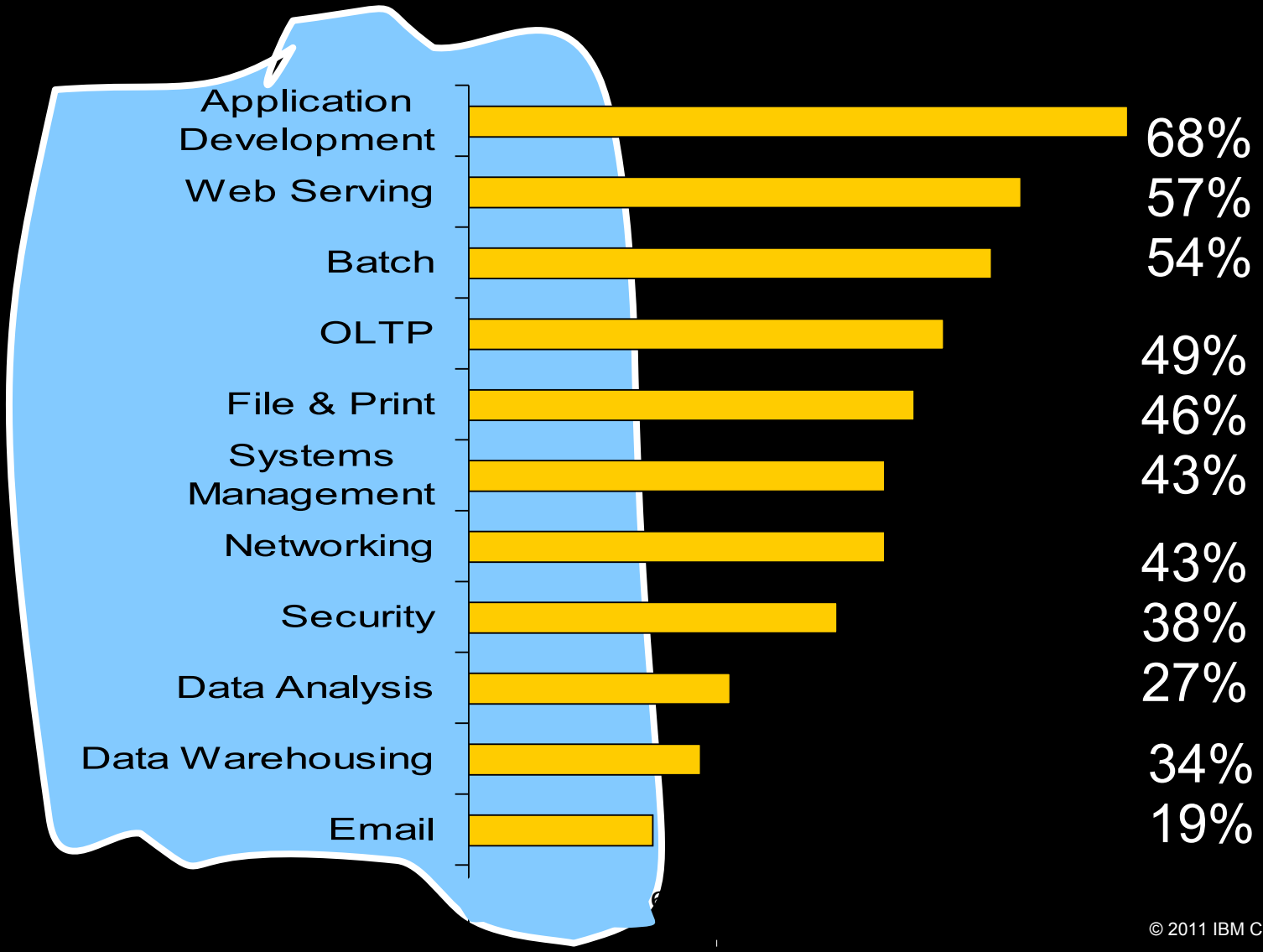
A Proof of Concept is designed to demonstrate the feasibility of a solution.

You should not confuse this with a system state which is either “close to production” or can be transferred into a production environment easily.

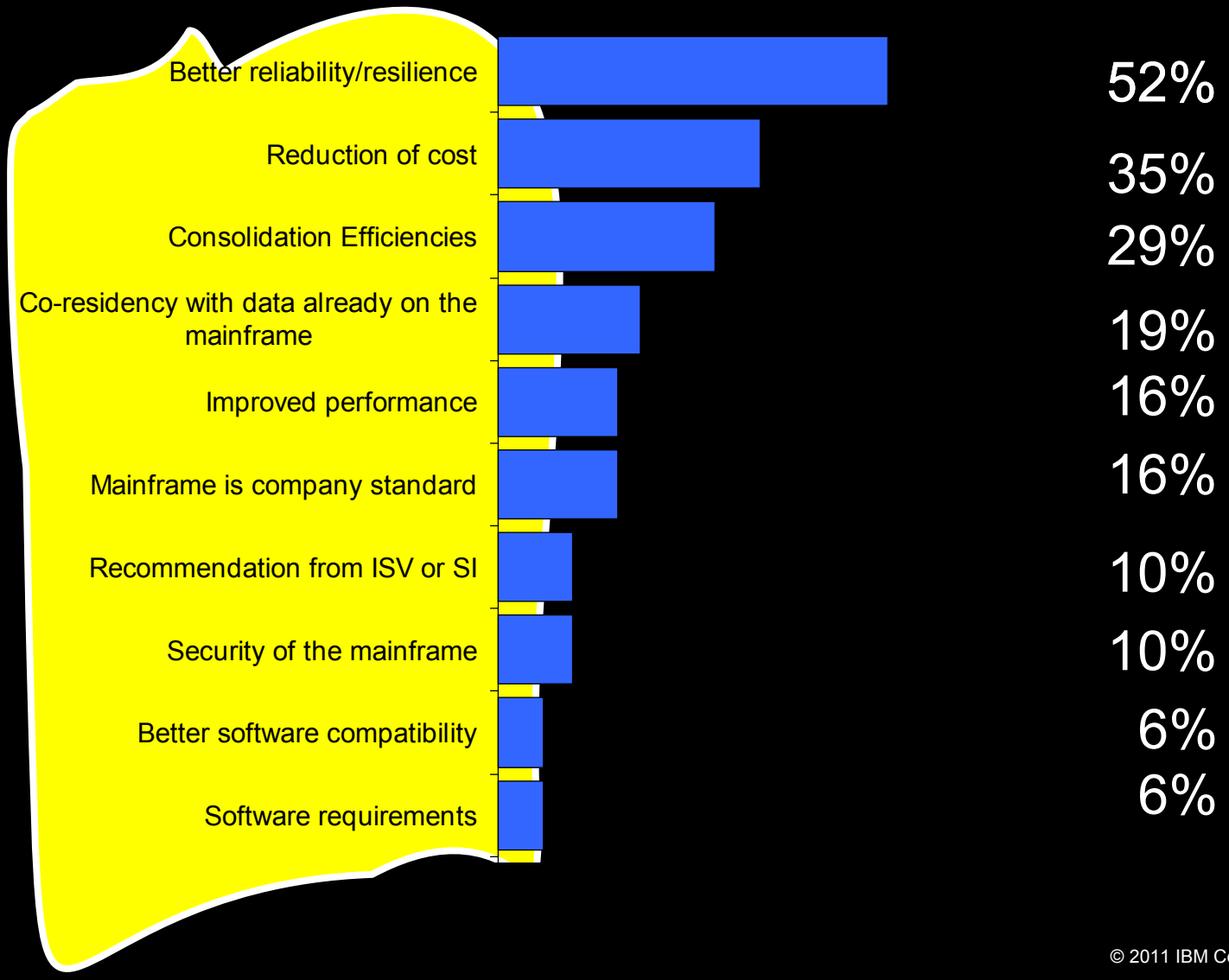
Workload share on utilized IFLs
Primary applications in the past

60%	Application serving for z/OS e.g. WebSphere, SAP, CICS TG, DB2 Connect
30%	Data serving e.g. Oracle DB, DB2 UDB
5%	Workplace serving e.g. Domino, Scalix, other e-mail
5%	Infrastructure serving e.g. Apache, Samba, NFS, etc.
<1%	Linux application development/deployment

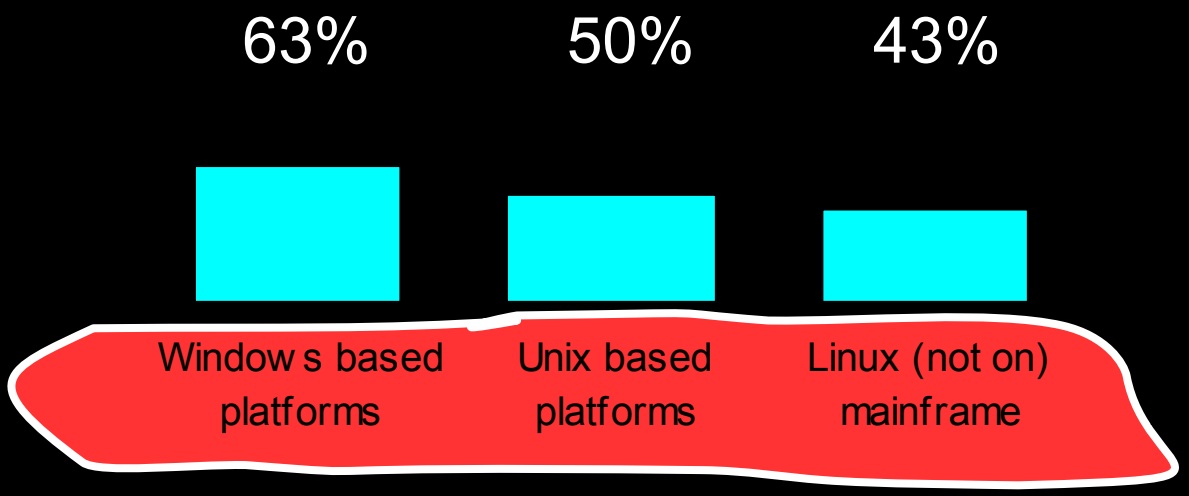
Latest Customer Survey: Workloads run on Linux System z (Existing Customers)



Latest Customer Survey: Migrations Reasons



Latest Customer Survey: Previous Platform for Consolidated Workloads



Clients Deploy Dedicated ELS Servers

For Workload Consolidation with Linux

"It has really ticked all the boxes. It reduced the dependency on a data centre, it reduced the complexity from over 60 servers down to one box, it enabled us to put a lot more robustness around it in terms of DRP and scalability, and was environmentally friendly as well."

– Steven Coles, CIO, Allianz

Smart is: Consolidating from over 60 servers to just one!

Allianz

Reduced IT costs – paid for itself in just over a year

kVA power usage down from about 40 to 4

Minimum disruption in cutover to new server

Source: "Allianz consolidates from 60 servers to 1 mainframe in 48 hours" Computerworld, November 4, 2009 -- http://www.computerworld.com.au/article/324815/allianz_consolidates_from_60_servers_1_mainframe_48_hours

Oracle

Long-Term Partnership: Oracle & IBM have partnered for over 21 years (JD Edwards over 30 Years)
- More than 19,000 joint customers worldwide
- IBM has on-site resources at Oracle locations dedicated to testing all major Oracle applications

The core factor for z196 does not change

Oracle 11GR2 for z was released
In March 2011

… We are happy
To assist in Oracle DB
Migrations
to Linux on System z …

Collaborate

Compete

We also have some nice
Databases in our
Portfolio

Oracle

"A growing number of customers are deploying System z virtual Linux servers on the Oracle Grid. Now with IBM's new aggressive pricing for Linux processors IBM has improved the economics of running Oracle solutions with IBM System z servers."

Matt Puccini, Oracle

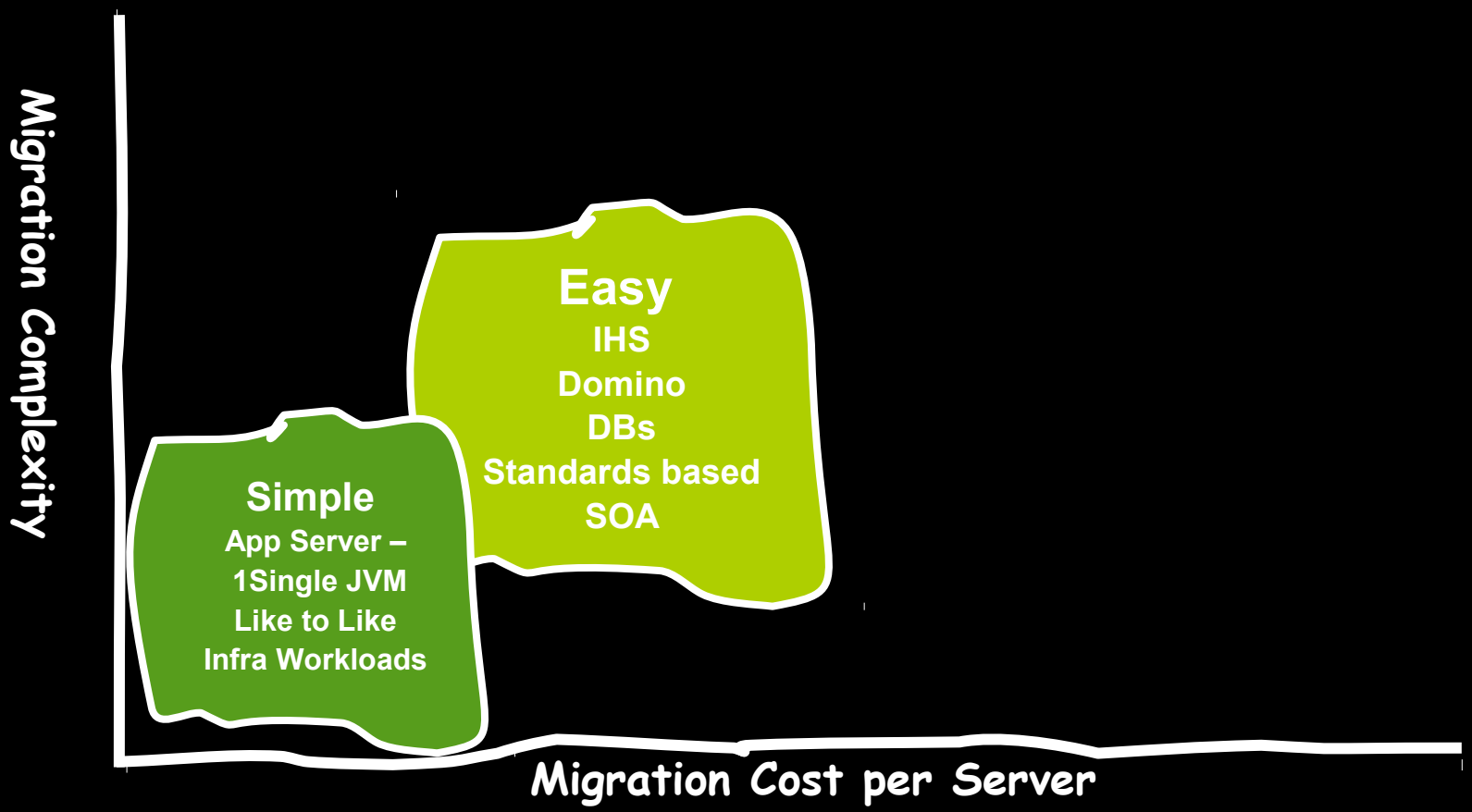
Managing Director Oracle/IBM Integrated Solutions

Workload Migration Complexity

Strategy: Segment migration costs based on complexity of workload

Objective: Minimize risk by segmenting applications into price / variability segments

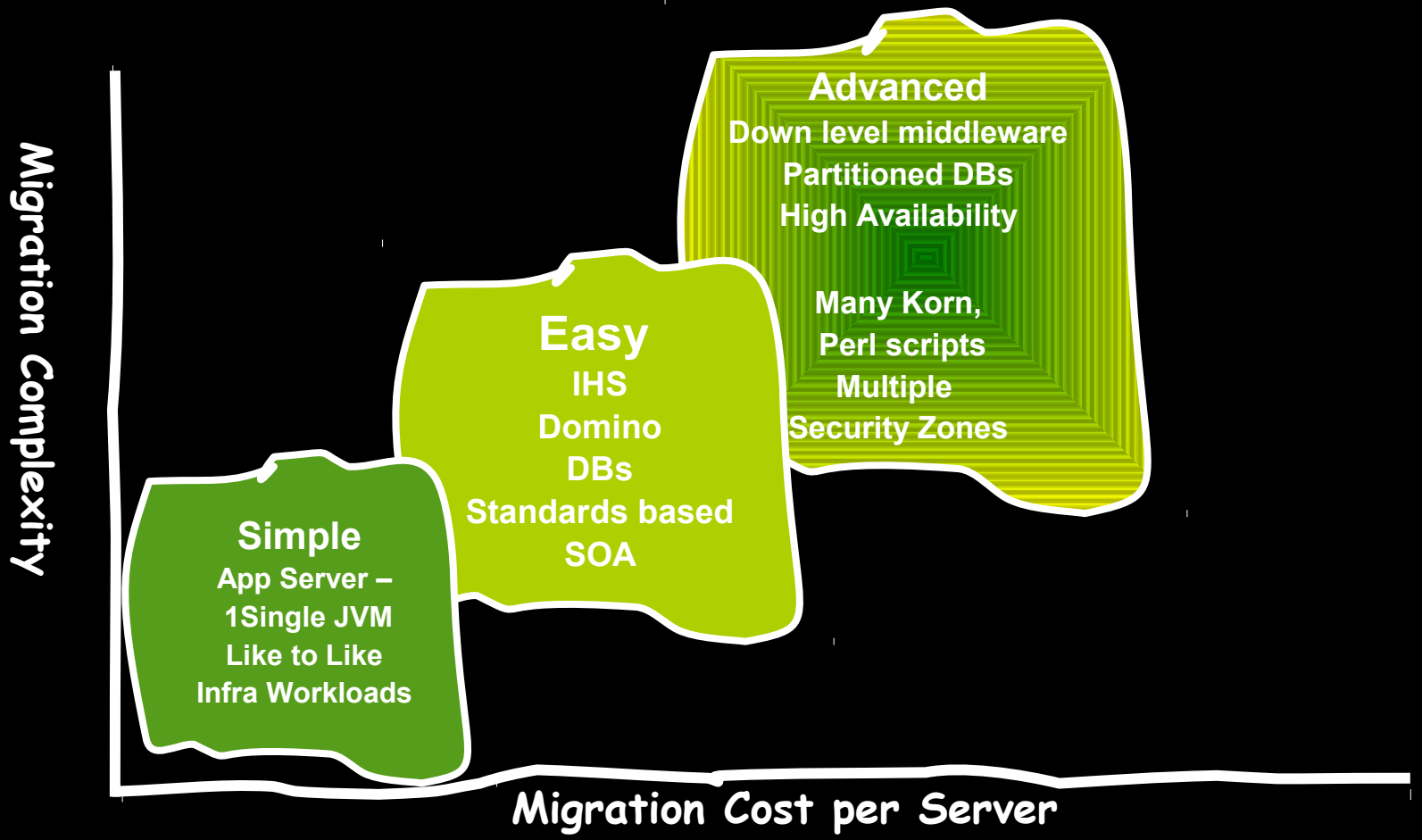
Workload Migration Complexity



Strategy: Segment migration costs based on complexity of workload

Objective: Minimize risk by segmenting applications into price / variability segments

Workload Migration Complexity



Strategy: Segment migration costs based on complexity of workload

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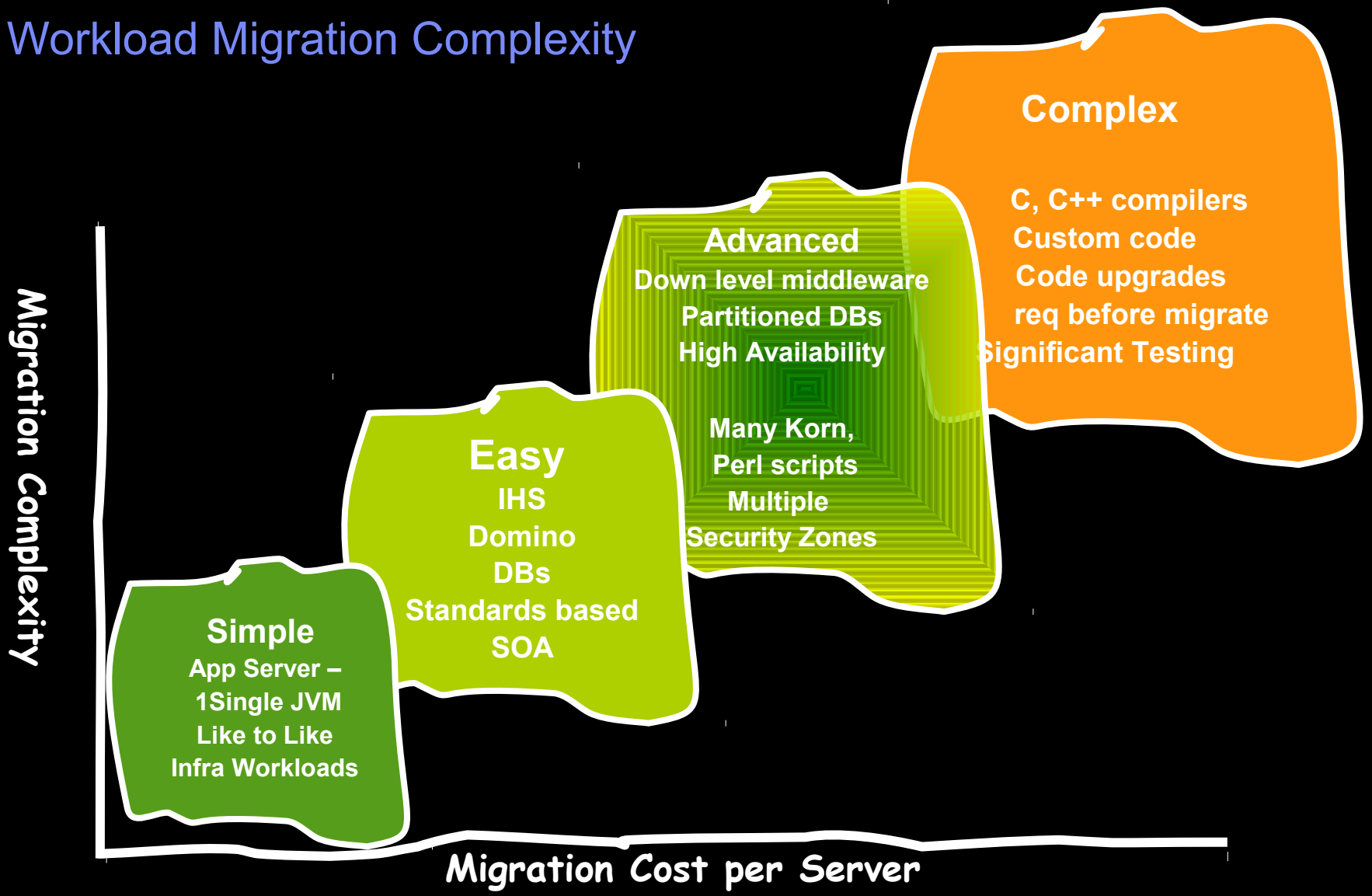
Workload Migration Complexity



Strategy: Segment migration costs based on complexity of workload

Objective: Minimize risk by segmenting applications into price / variability segments

Good fit application workloads

- WebSphere MQ
- DB2 Connect
- CICS Transaction Gateway
- IMS Connect for Java
- SAP
- WebSphere and JAVA applications development
- WebSphere Application Server (WAS), Portal
- Domino
- Network Infrastructure, FTP, NFS, DNS, …
- Oracle Database
- ...

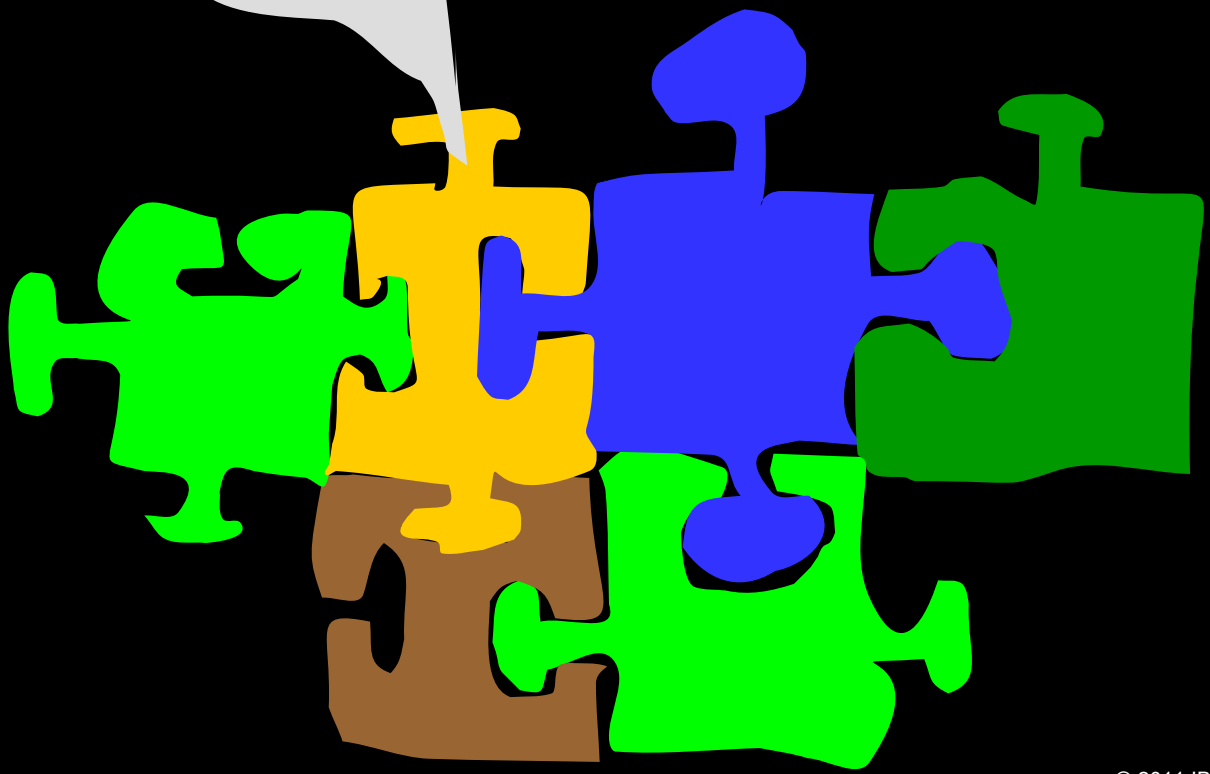
- Applications requiring top end disaster recovery model
- Communications Server and Communications Controller for Linux
- Virtualization and Security Services
- InfoSphere
- Cognos
- Communigate Pro (VoIP)
- ...

Application Selection

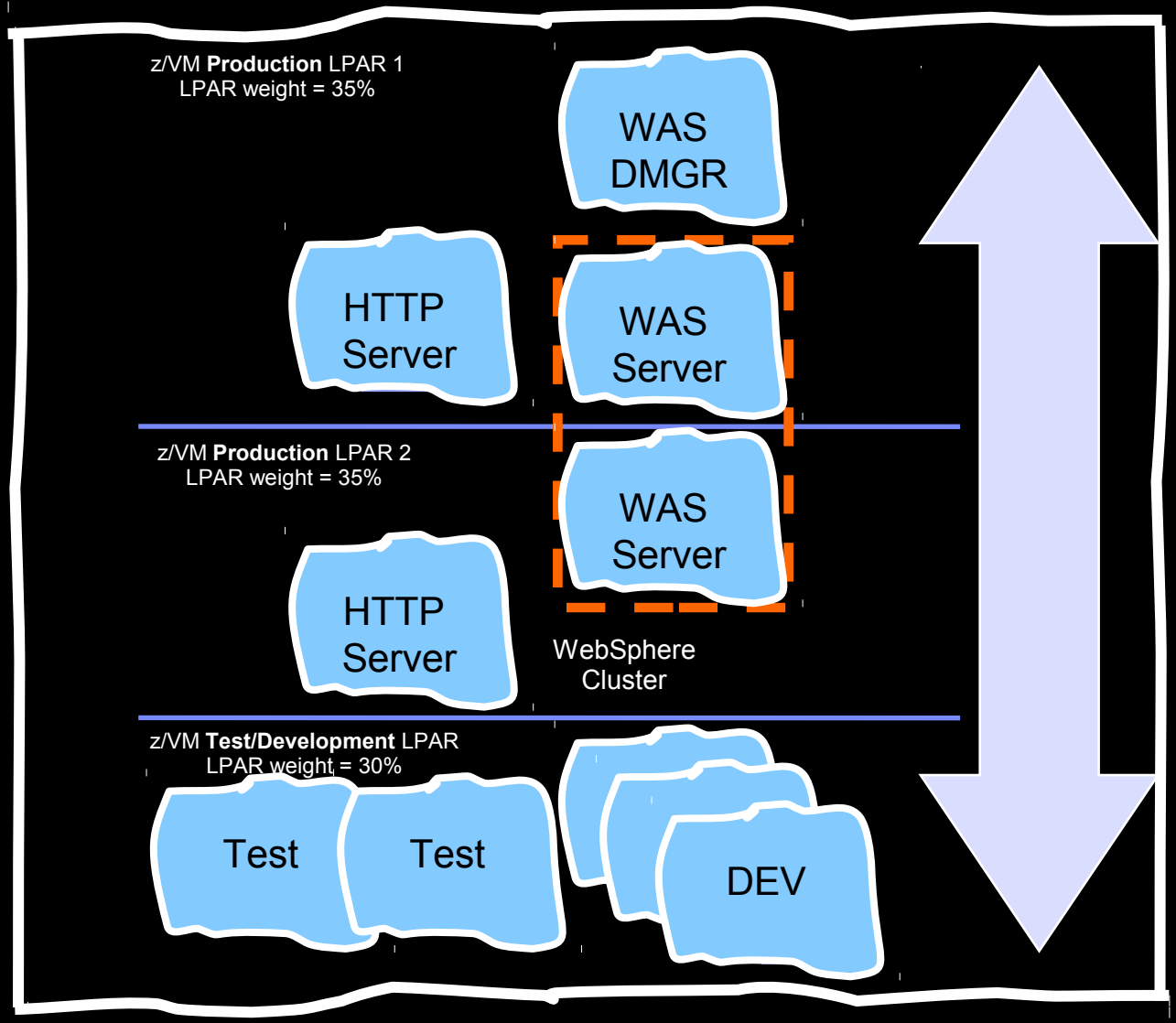
- What applications are you going to run?
- Not everything that runs on Linux is available for Linux on System z. (Open Source included!)
- Ask your ISVs to be specific; they may need to “get back to you.”
- All Open Source, all commercial, or a mixture?
- What are the virtual/real storage requirements for the applications to be run?
- Oracle can be a tremendous storage hog: But the per-processor licensing can give big savings on the software license
- How much disk space is going to be needed?
- This can drive the decision on SCSI versus ECKD
- Aggregating 3390-#'s into multiple Terabyte file systems is a pain

Have a look at the IBM Linux on System z ISV Application Directory:
http://www-03.ibm.com/systems/z/solutions/isv/linuxproduct.html

What is missing?



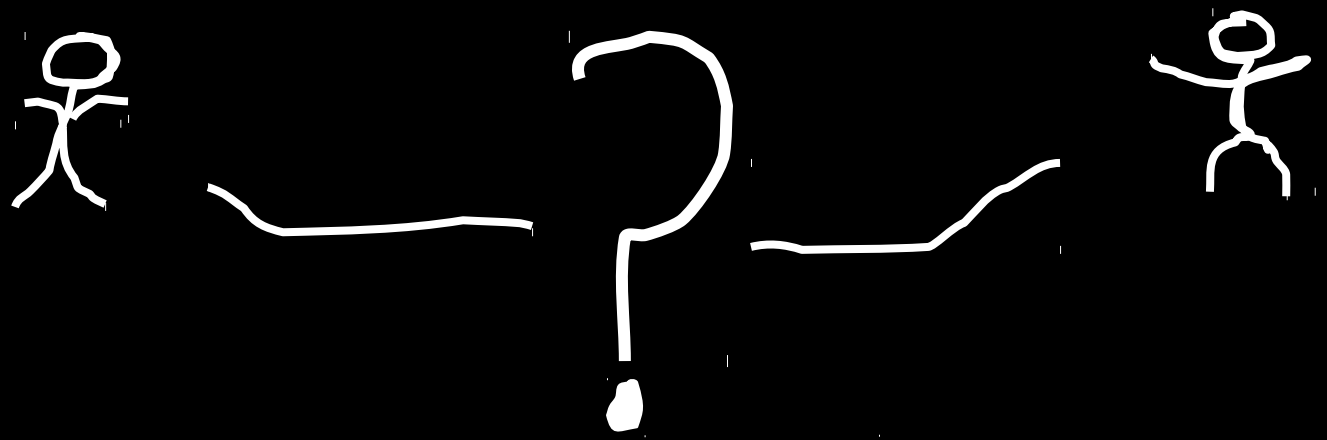
Typical Recommended Solution on Linux on System z



Each blue box is a virtual Linux server.

- All Linux virtual servers draw from a common pool of memory and IFLs.
- Resources from a failed server flow to surviving servers
- Small application clusters (Just enough nodes for failover)
- Smaller cluster reduces failure points
- Two LPARs run production workload.
- Applications run in clusters split between the prod LPARs.

Deciding on a Distribution



Novell / SuSE

Red Hat

Deciding on a Distribution

- IBM is neutral: We usually don't recommend one distribution or the other.
- Compared to the Linux on x86 market you are in the fortunate position that you only have to choose between two distributors ☺
- Novell and RedHat are strategic partners of IBM.
- You can also run GNU/Debian Linux but then you can only get support from a limited number of 3rd parties (e.g. System z BP's) -also no ISV application is certified for Debian on z.
- Don't ask us about the market share. Each distributor provides different numbers which add up to more than 100% and we don't track this data on our side

Deciding on a Distribution: **Some Advice**

- If you are already familiar with one distribution on x86 you might want to run the same flavor on the mainframe
- If you plan to host an ISV application make sure that it is certified for the distribution of your choice (not all products are certified for each distro.
- Also check the release level (e.g. 5.5, 10.2)
- If you are still unsure, invite a representative of each distribution to your side

Enterprise Linux Distributions – Tested & Supported

http://www-03.ibm.com/systems/z/os/linux/resources/testedplatforms.html

Methodology for Installing and Maintaining Linux

- Cloning
- Manual installation – nobody wants to install 20 servers manually, no matter if they run on x86 or the mainframe!
- Autoyast (SuSE)
- Kickstart (Red Hat)

The Why, What of Cloning

Why Cloning?

- Standardized configurations
- Facilitates maintenance testing & rollout
- Time savings
- Cost savings

What can be cloned?

z/OS: It takes ~ 2.0-2.5 Hours. Cloned by running ~50 batch jobs)

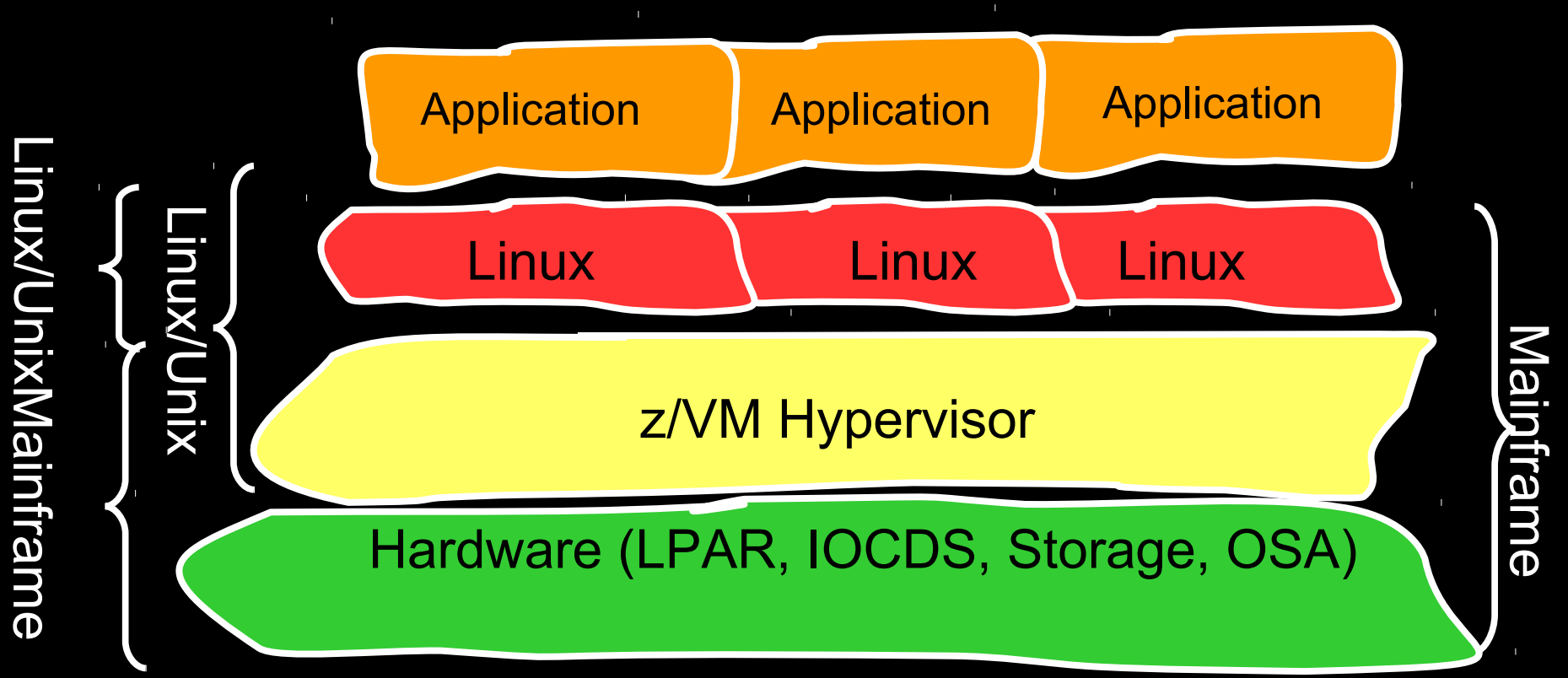
z/VM: Takes about 2-3 minutes to clone z/VM But takes 20-30 min if Flash Copy is not available)

z/Linux: Virtual Servers are cloned in < 5 minutes. ~15 minutes if Flash Copy DASD feature not available

Who will be responsible for the virtual Linux environments

Organizational challenges and the question about responsibilities an

where to draw the line between various departments



Which skills are needed?

Mainframe Hardware / Storage / Network
(no difference with a z/OS shop)

Which skills are needed?

z/VM: Installation, Configuration, Management
-critical for the Linux deployment,cloning,....

Mainframe Hardware / Storage / Network
(no difference with a z/OS shop)

Which skills are needed?

Linux: The difference between Linux on x86 and System z is usually smaller than expected

z/VM: Installation, Configuration, Management -critical for the Linux deployment,cloning,....

Mainframe Hardware / Storage / Network (no difference with a z/OS shop)

Which skills are needed?

Middleware: Websphere is Websphere in most Cases no matter on which OS/plattform we run it

Linux: The difference between Linux on x86 and System z is usually smaller than expected

z/VM: Installation, Configuration, Management -critical for the Linux deployment,cloning,....

Mainframe Hardware / Storage / Network (no difference with a z/OS shop)

Which skills are needed?

Application: If possible – adjust your application to the characteristics of a virtualized environment

Middleware: Websphere is Websphere in most Cases no matter on which OS/plattform we run it

Linux: The difference between Linux on x86 and System z is usually smaller than expected

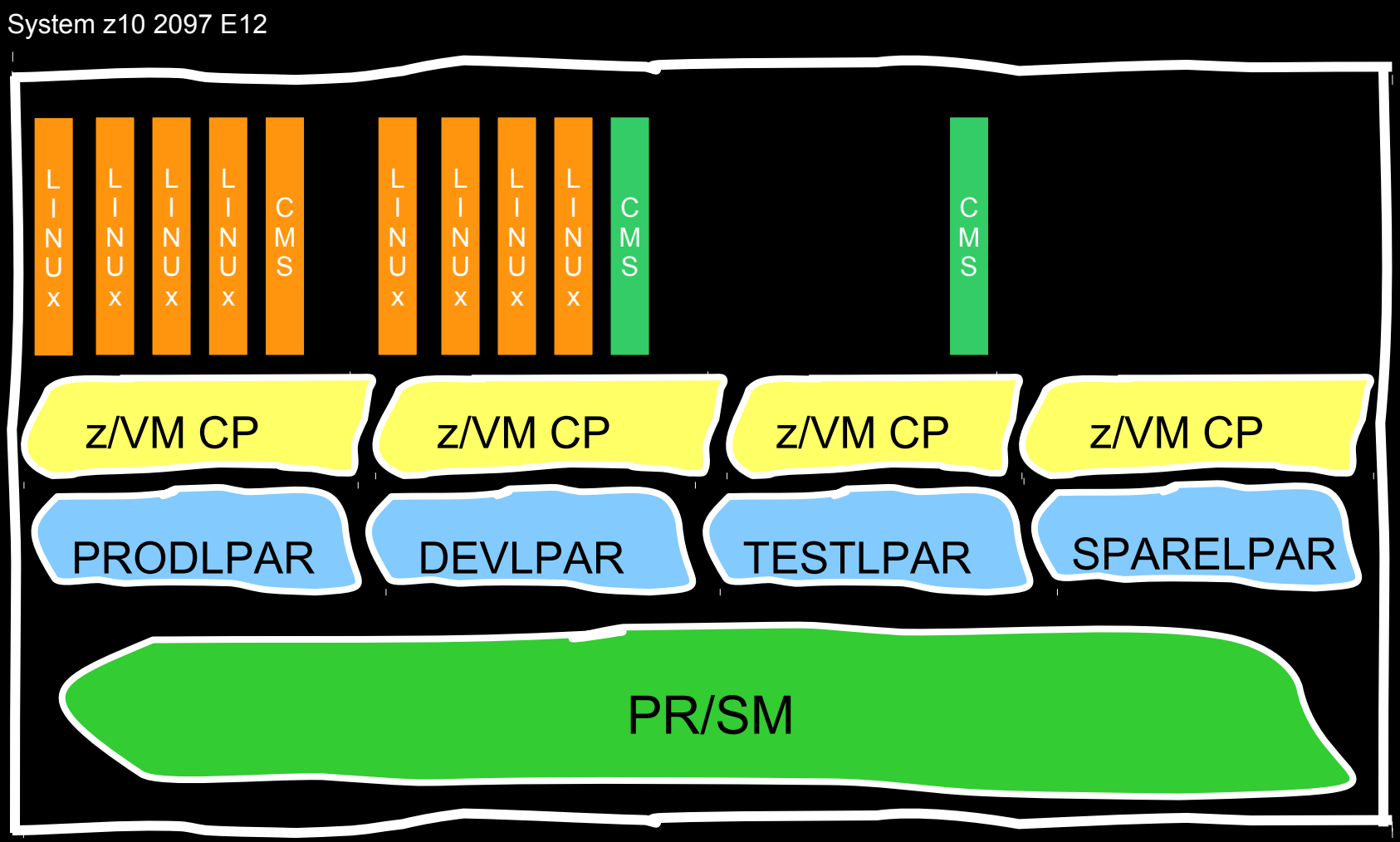
z/VM: Installation, Configuration, Management -critical for the Linux deployment,cloning,....

Mainframe Hardware / Storage / Network (no difference with a z/OS shop)

A typical customer: ACME Inc.

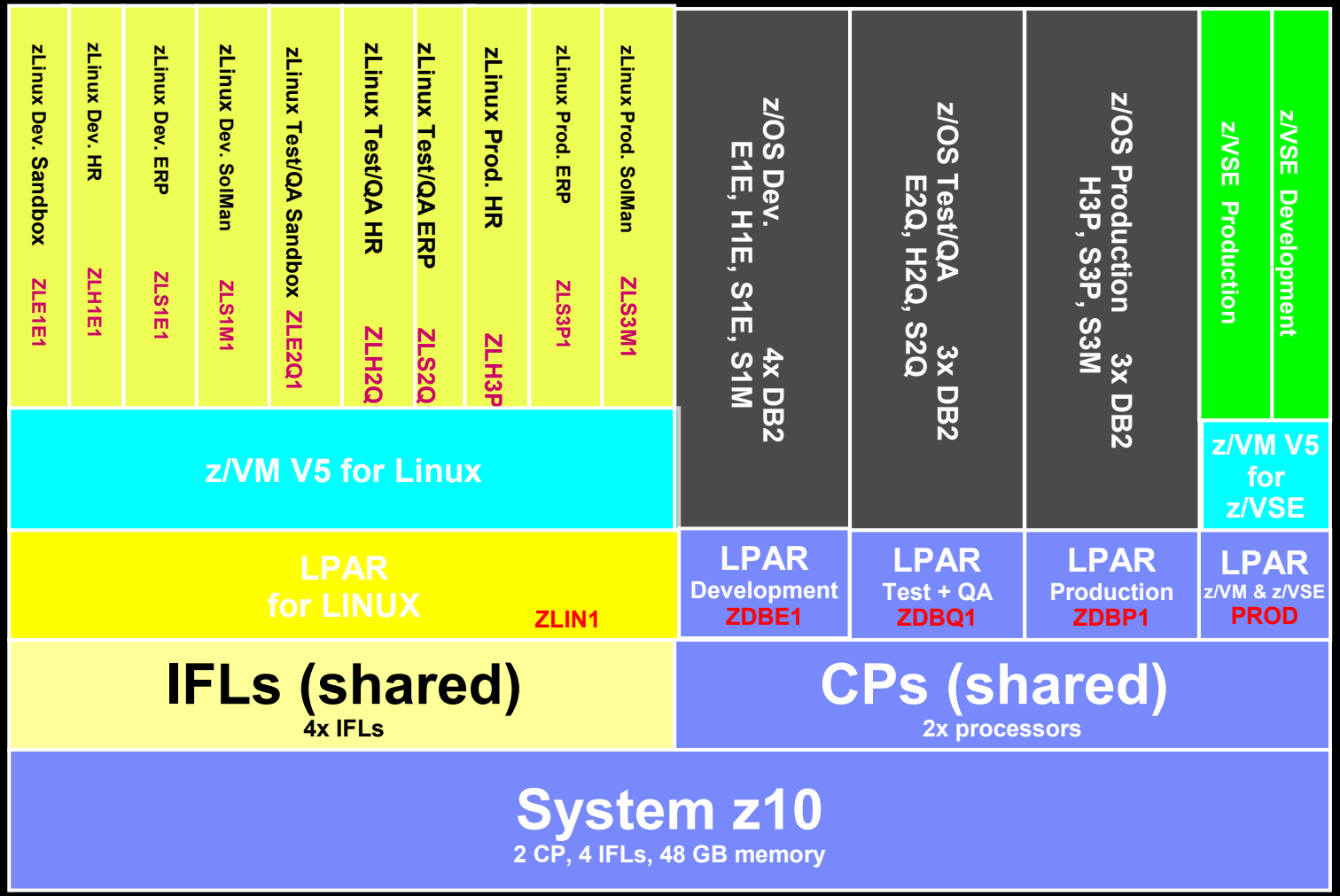
- During the second half of 2010 ACME Inc. purchased an IBM System z mainframe to act as a server consolidation platform.
- Hardware (excerpt)
  - IBM System z10 Enterprise Class
    - Model: 2097-E12
    - 96GB memory
    - 3 Integrated Facility for Linux (IFL) CPU's
  - IBM System Storage DS6800 Disk
    - Model: 1750 522
    - Parallel Access Volume (PAV) license.
- In z10 has been configured with 4 LPARs: Production, Development, Software and one reserved for future use.
- The system is going to be used as a server consolidation platform.
  - Multiple WebSphere servers running on Intel machines will be consolidated to Linux servers running as virtualized guests hosted by the z/VM operating system.
  - Each LPAR will run a z/VM 6.1 operating system.

Architectural Setup: ACME Inc.



For the initial implementation each LPAR has been given access to 3 shared IFL's i.e. no dedicated IPL's have been configured
IFL Weight: 70% Production, 10 % Development, 10 % Test, 10 % Spare LPAR

Customer Example I



SAP Requirement: Dev, Test & Prod Systems

EFiS Financial Solutions...

Resolves data center Pain Points and further optimizes the IT infrastructure using the IBM Enterprise Linux Server

Business need

The driving business challenge at EFiS was the requirement to reduce cost, risk and resources while increasing the efficiency and ecology at the same time. Security requirements, scalability and the need to process huge amounts of transactions while saving cost for software licenses furthermore lead to the decision to move from various hardware platforms (including x86, p-Series, SPARC/Solaris and HP) to System z running Linux.

Solution

Migrating various servers from different vendors to one IBM System z9 BC (Linux only machine), EFiS managed to optimize their data center back in 2008. The fact that fewer server had to be managed, lead to an easier control and operation of the existing environment. With the update of the current production z9 to a z10 based Enterprise Linux Server, EFiS continuous the optimization of their IT-infrastructure to the constantly changing business requirements.

Benefits:

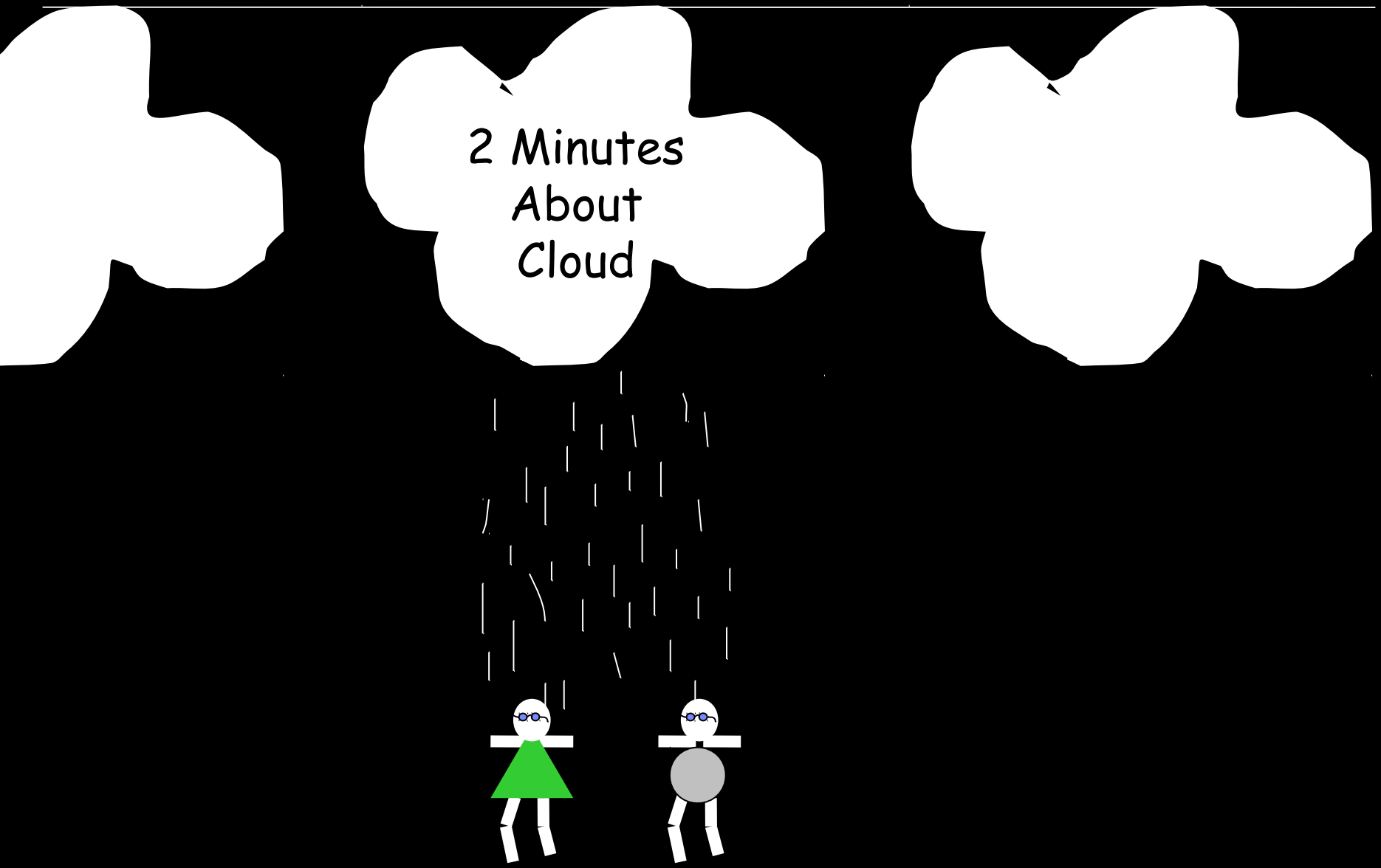
- The Continuous optimization of the IT-Infrastructure lead to fewer servers to manage – and to ease the control and operation
- Reduced cost, risk and resources
- Recovered data center floor space
- Strengthened ability to scale with business growth

"We chose an IBM Enterprise Linux Server with a System z Business Class configuration, running SUSE Linux Enterprise Server for System z from Novell for the high reliability, advanced security, extreme scalability and high compute power this solution offers," said Ernst Bauer, Chief Operating Officer at EFiS Financial Solutions AG.

"Another crucial factor for the decision to move to this combined solution was the energy and power savings this offering from IBM and Novell could provide us.

Together with our implementation partner PROFI Engineering Systems AG we were able to integrate Green IT as an important part of our strategy.

SUSE Linux Enterprise Server for System z on an IBM Enterprise Linux Server Business Class provides us with optimal resource utilization, while addressing our critical energy and power costs."



Cloud Service Lifecycle Management

Deploy Service
- Request Driven Provisioning
- Management Agents and Best Practices
- Application / Service On Boarding
- Self-service interface

Subscribe to Service
- Request a service
- "Sign" Contract

Manage Operation of Service
- Visualize all aggregated information about situations and affected services
- Control operations and changes
- Event handling
- Automate activities to execute changes
- Include charge-back

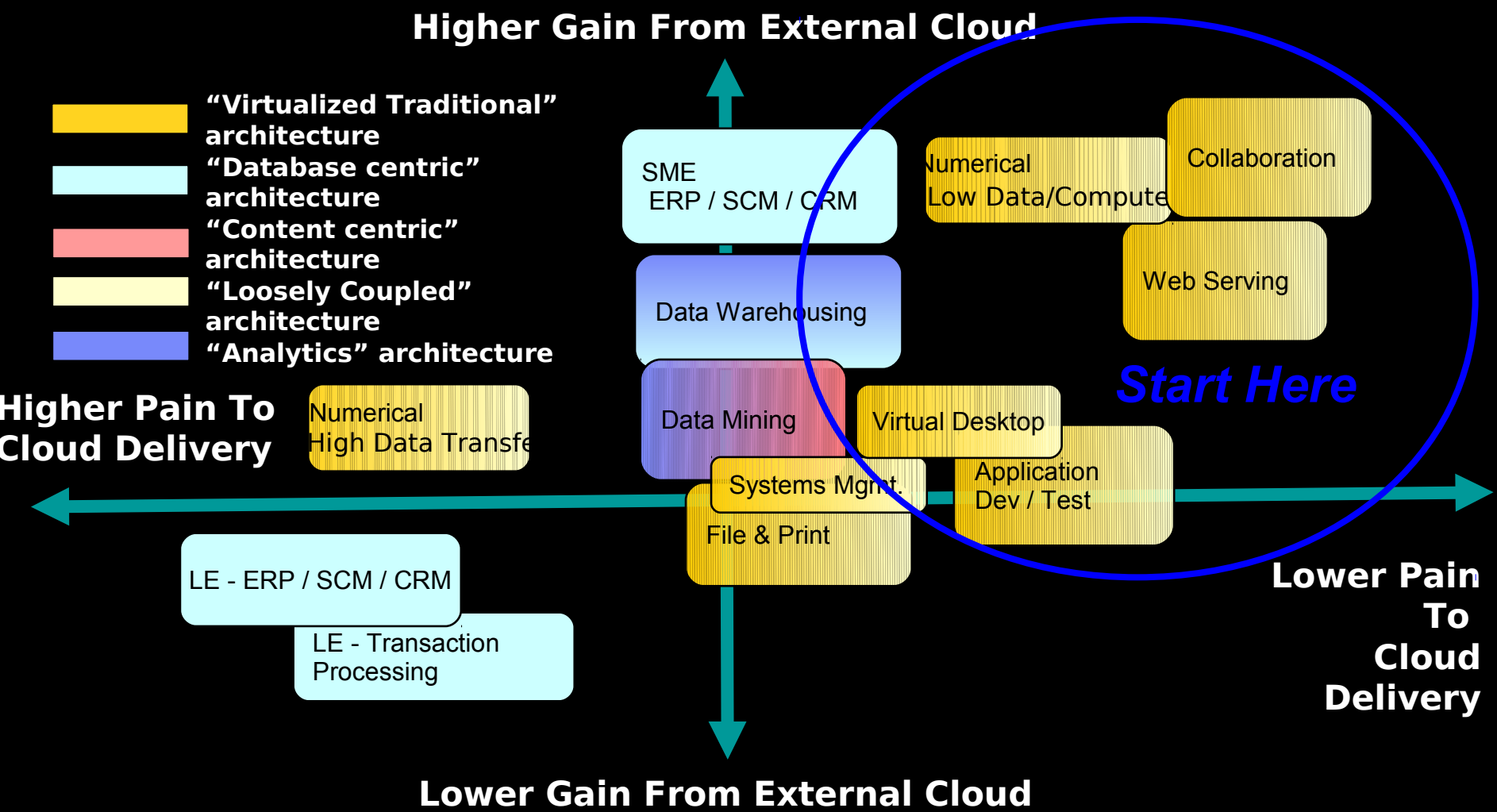
Offer Service
- Register Services and Resources
- Add to Service Catalog

Service Creation
- Scope of Service
- SLAs
- Topologies, Best Practices Management Templates

Terminate Service
- Controlled Clean-up

6 Components of Cloud
Supports z/VM and Linux

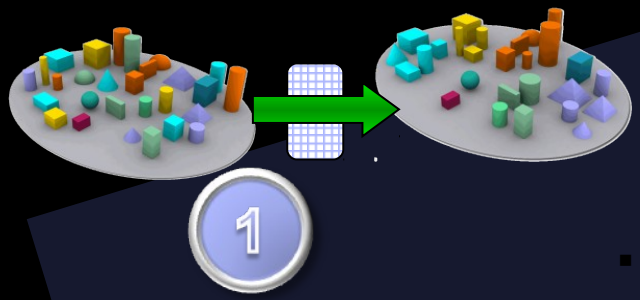
Clients Will Adopt Cloud Computing Based on Workload Affinity



A Step-by-Step Approach for Growing Cloud on zEnterprise

Take Out Cost

STEP 1
Consolidate and Virtualize

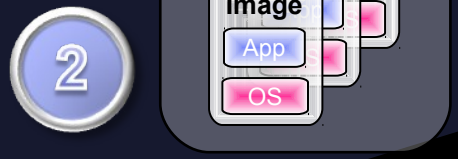


Exploit the extreme virtualization capabilities of System z and z/VM

Use basic z/VM features and functions to manage virtual Linux servers

Simplify

STEP 2
Automate and Manage Better



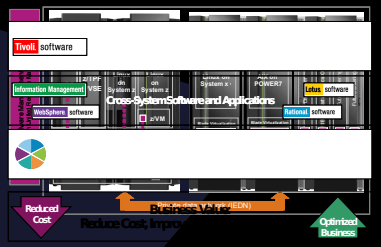
- Use advanced z/VM features and functions for automated operations and service delivery

Introduce Systems Director for additional image management

Add Tivoli technologies for greater levels of service management

Integrate and Optimize

STEP 3
Cross-architecture Workload Optimization



- zEnterprise is the industry's only multi-architecture cloud solution

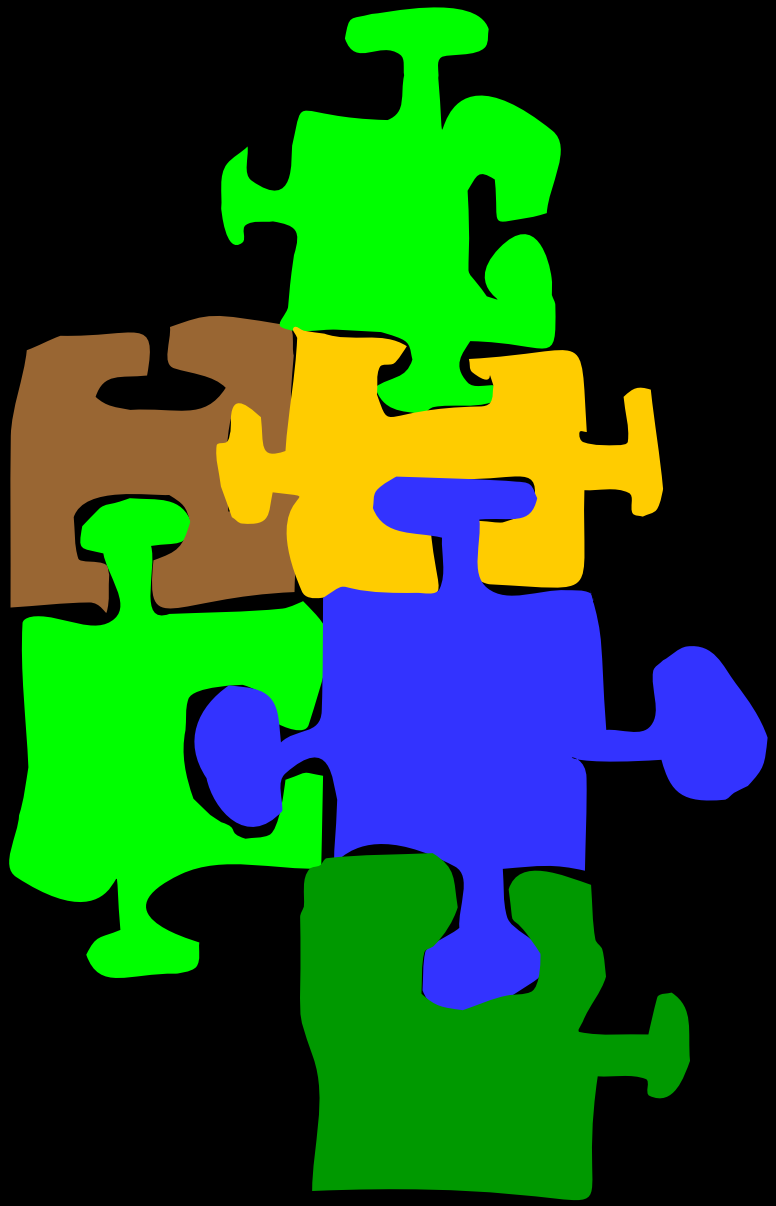
Use a cloud deployment model to host multi-tier solutions across System z, POWER and System x resources

Use the Unified Resource Manager and Tivoli ISM for optimal workload placement

Cloud Offerings and Products

(z10, z196) Solution Edition for	VMControl Solution Edition for Cloud	zManager Tivoli Integrated Service

Cloud Service Models



Business Process as a Service

Software as a Service

IBM Smart Analytics Cloud for System z

Platform as a Service

IBM WebSphere CloudBurst Appliance

Infrastructure as a Service

IBM System z Solution Edition for Cloud Computing

Universita di Bari

Innovative Cloud Solutions for Local Businesses

Fish Market

Electronic fish auction for fishermen while on boats

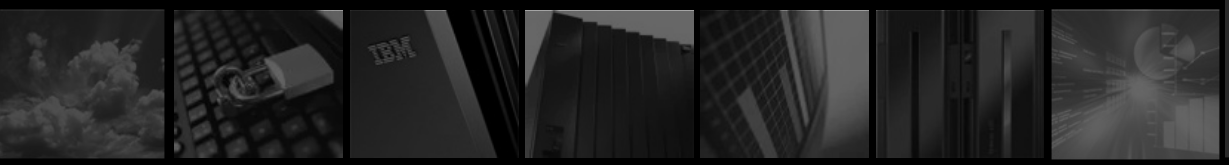
Wine Market

Support for 60 wineries to determine demand and get best market price

MoniCA

Logistics solution tracks and collects data real-time

Solution Edition for Cloud Computing



BENEFITS to Clients

Using cloud computing to allow multiple entities to tap into heavy-duty computing power at minimal cost and lowers the barrier to help local businesses to benefit from this technology.

UNIVERSITÀ DEGLI STUDI DI BARI ALDO MORO

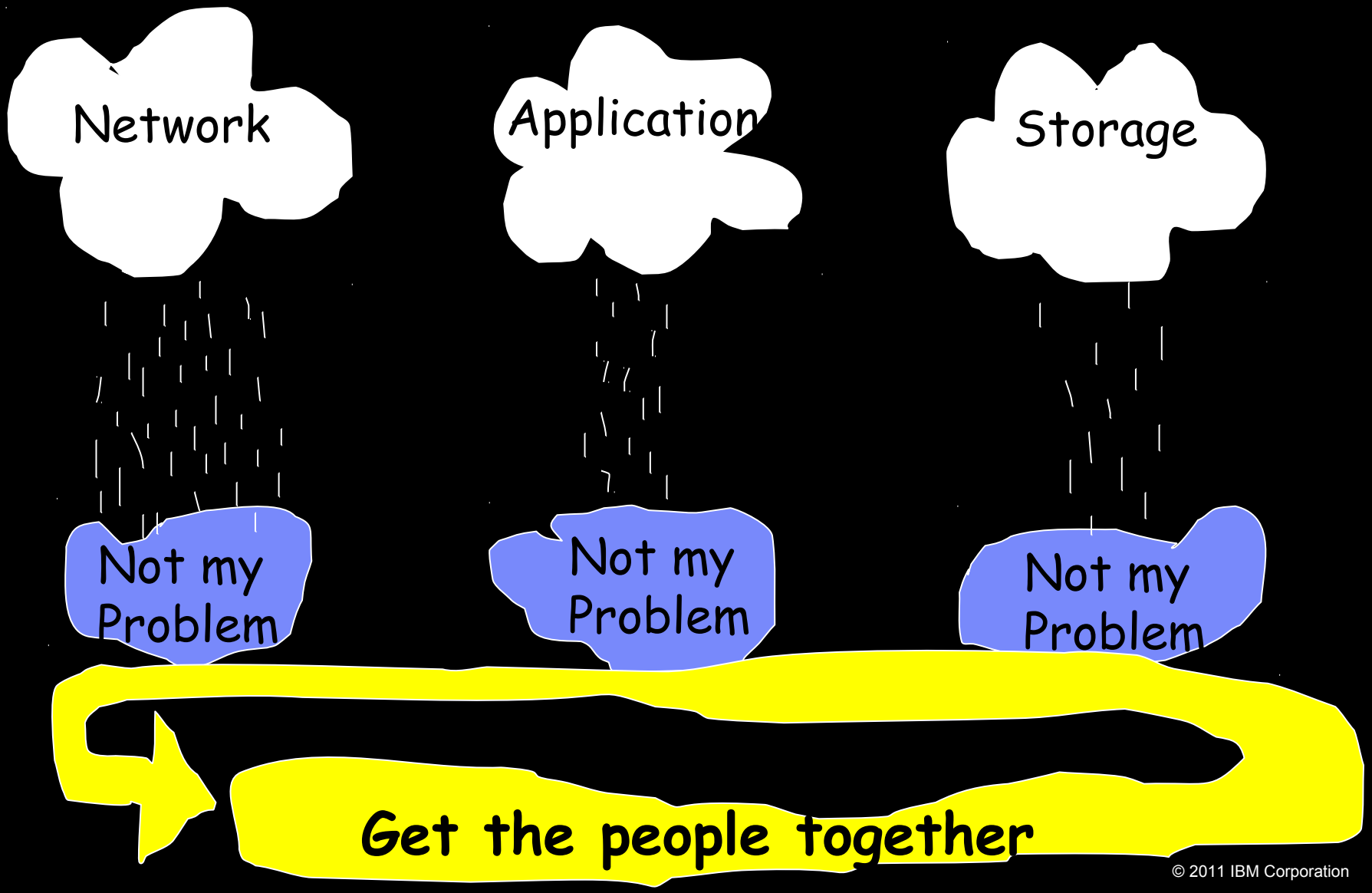
Universita di Bari, established since 1924, is developing cloud-based solutions for a consortium of companies and universities from five regions of southern Italy.

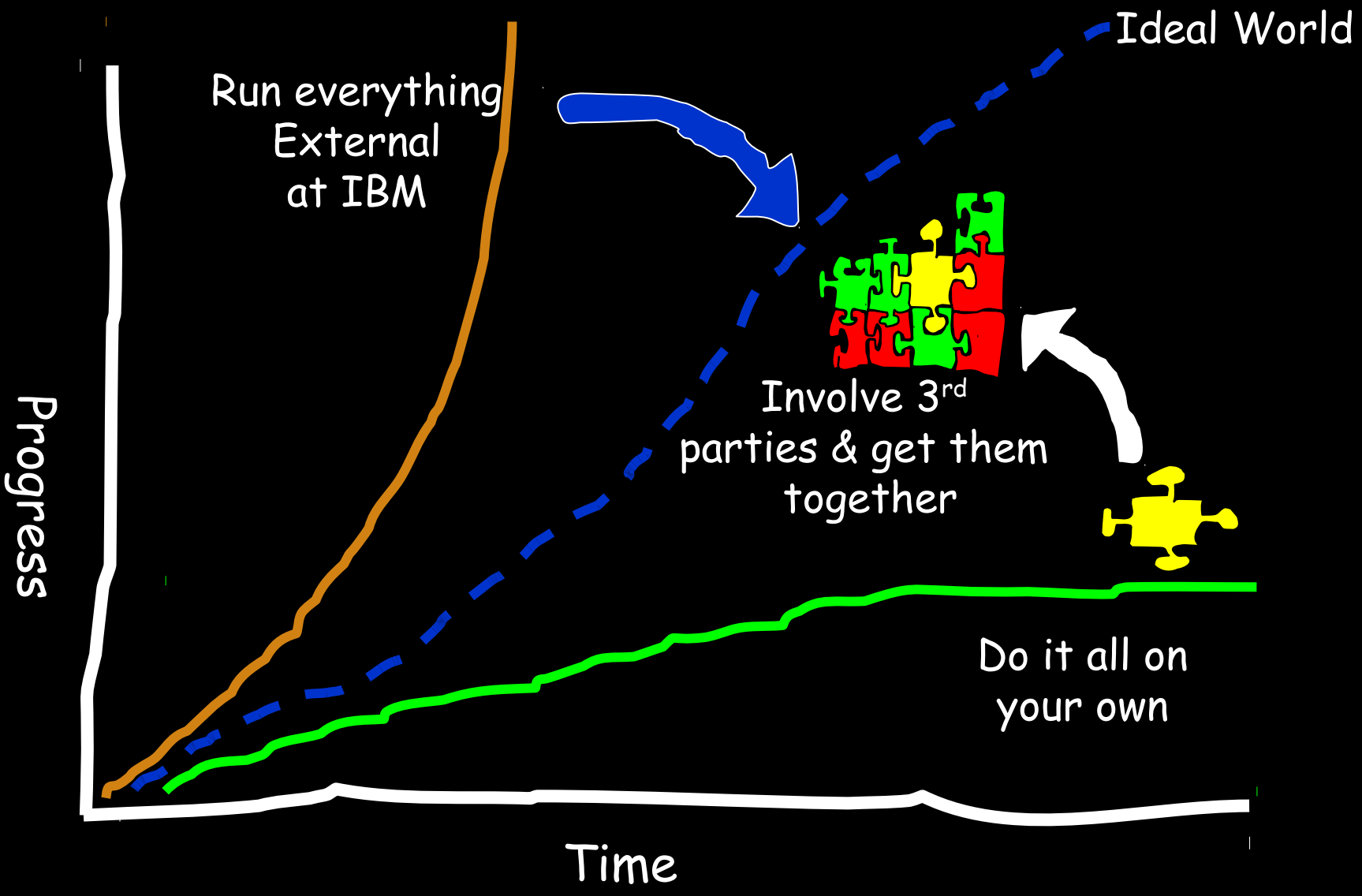
 Press release: http://www-03.ibm.com/press/us/en/pressrelease/32051.wss

Closing Thoughts

Key Points

- App to App Migrations are very easy
  - WAS to WAS
  - Oracle to Oracle
  - Domino to Domonio
- Start small
- Use the PoC to learn the new technology
- **Make use of hardware and software technologies to increase operational efficiencies and optimize workload performance *while reducing Total Cost of Ownership***





Competitive Considerations

- Are your customers doing these 5 things?
  1. Virtualization and server management
  2. Security services for entire enterprise
  3. Database and warehouse services
  4. Cloud and cloud management
  5. Application development and test
- These projects are not only what you customer is doing, they are projects that are very well suited to zEnterprise

Doing More for Less

Questions?

Hans-Joachim Picht

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Mobile +49 (0)175 - 1629201
hans@de.ibm.com

How to explain the benefits of running Linux on System z in 2:39?

http://www.youtube.com/watch?v=0i7kBnhN3Lg

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