redhat.

Trends & Observations in
Open Source Cloud Computing

IQT Technology Focus Day
August 10, 2011 | Arlington, Virginia

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Cloud Jeopardy!

	?	?	?	?	?	?
Cloud Type	SaaS	IaaS	IaaS	SaaS / PaaS	SaaS	SaaS / PaaS
Customers	55k Corp 1.5m Pers	100k+	50k+	1m+	750m+	10k+
Cloud Revenue	$1.5B	$500M	$56M	$50M	N/A	N/A

http://www.thetechtrendz.com/2010/07/top-5-cloud-computing-providers.html

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We're using commodity hardware running RHEL and it has been phenomenal It's 10x less expensive running RHEL and orders of magnitude faster.
- Parker Harris, Executive VP of Technology at SF.com

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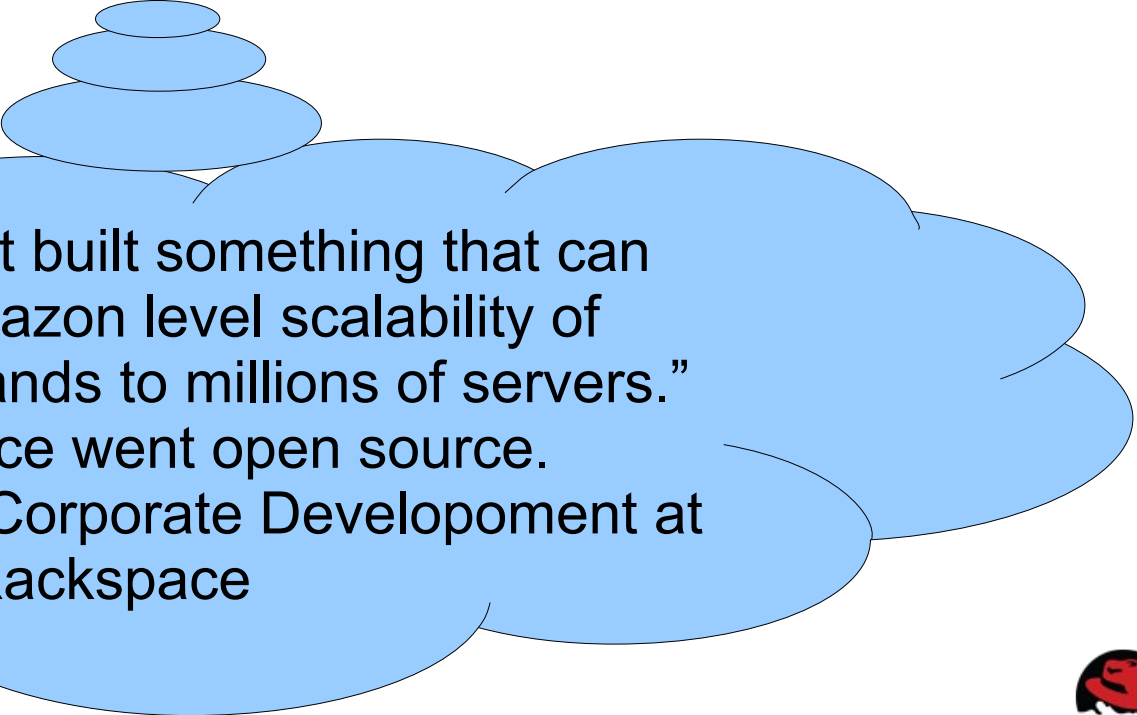
Amazon cut technology expenses by about 25% from $71M to $54M. The reduction was attributed primarily to Amazon's migration to Linux.
- http://news.cnet.com/2100-1001-275155.html

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"VMWare has not built something that can scale up to Amazon level scalability of hundreds of thousands to millions of servers."
So, Rackspace went open source.
- Jim Curry, VP of Corporate Developoment at Rackspace

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"Google announced last week that its cloud will run nothing but open source software."

- http://www.zdnet.com/blog/open-source/google-goes-all-in-with-an-open-source-cloud/5334

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"Facebook was built from the ground up on open source software.

- https://developers.facebook.com/opensource/

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Microsoft is proprietary, but note how they follow the open source clouds with things like Daytona (Hadoop replacement).
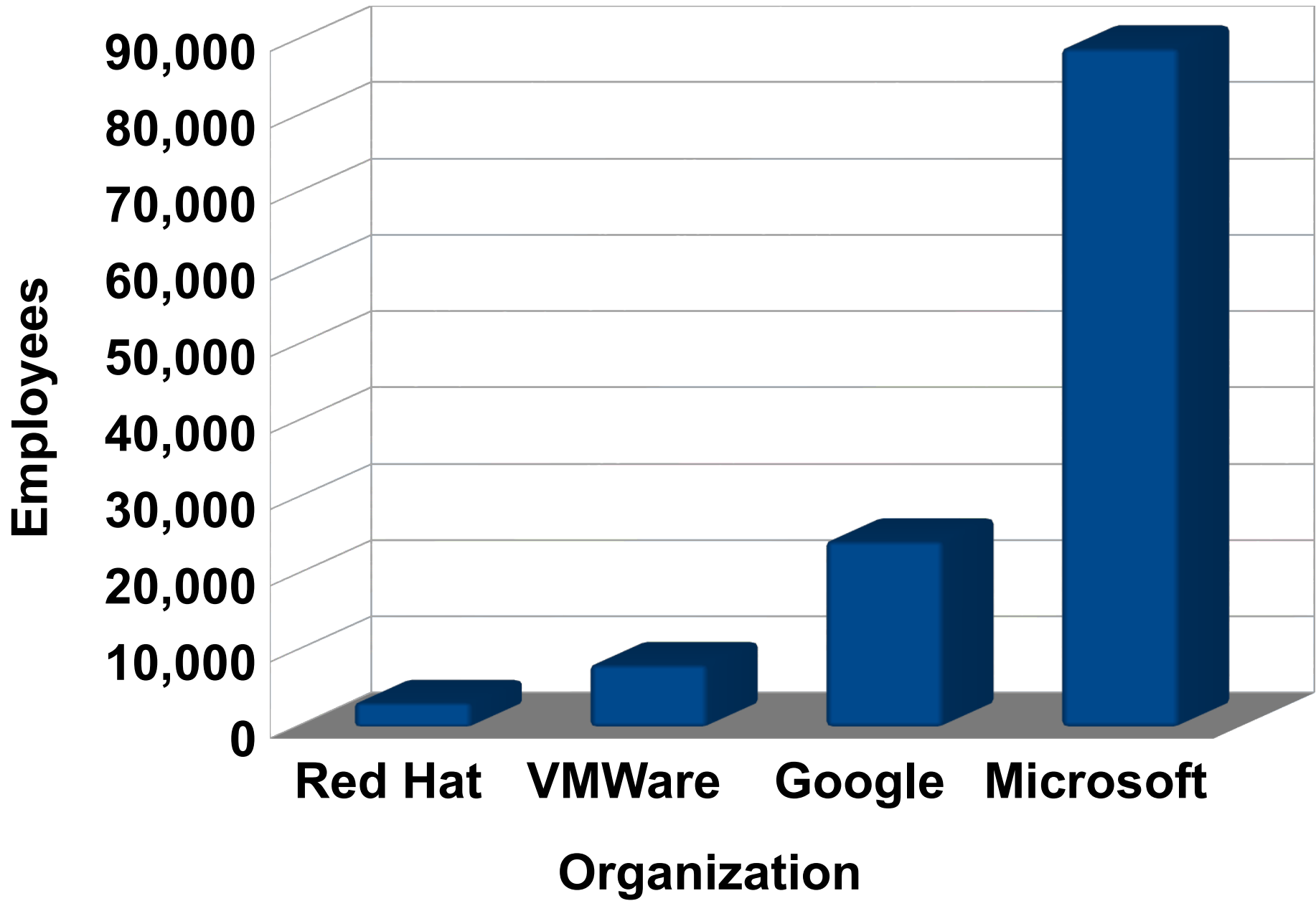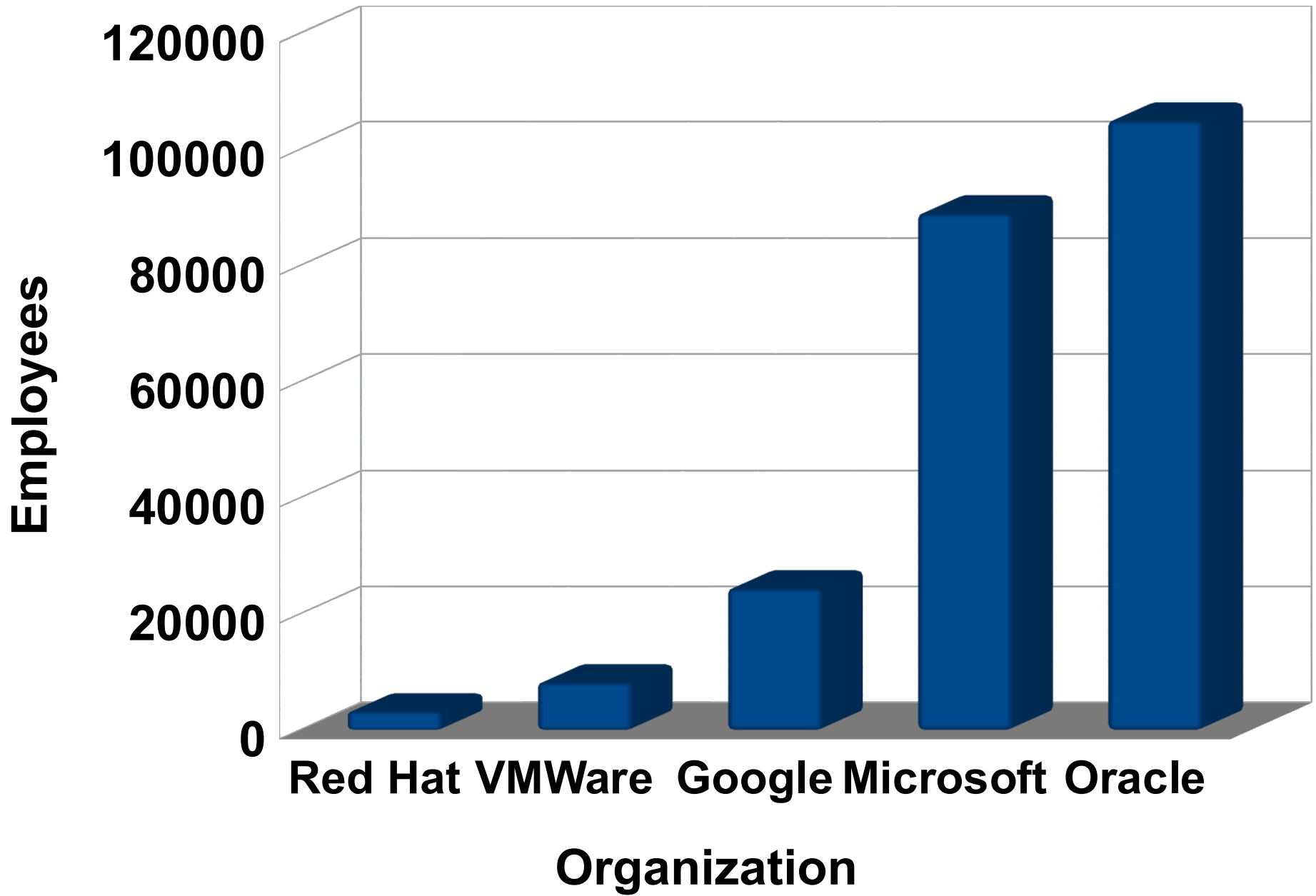
– http://research.microsoft.com/en-us/news/headlines/daytona-071811.aspx
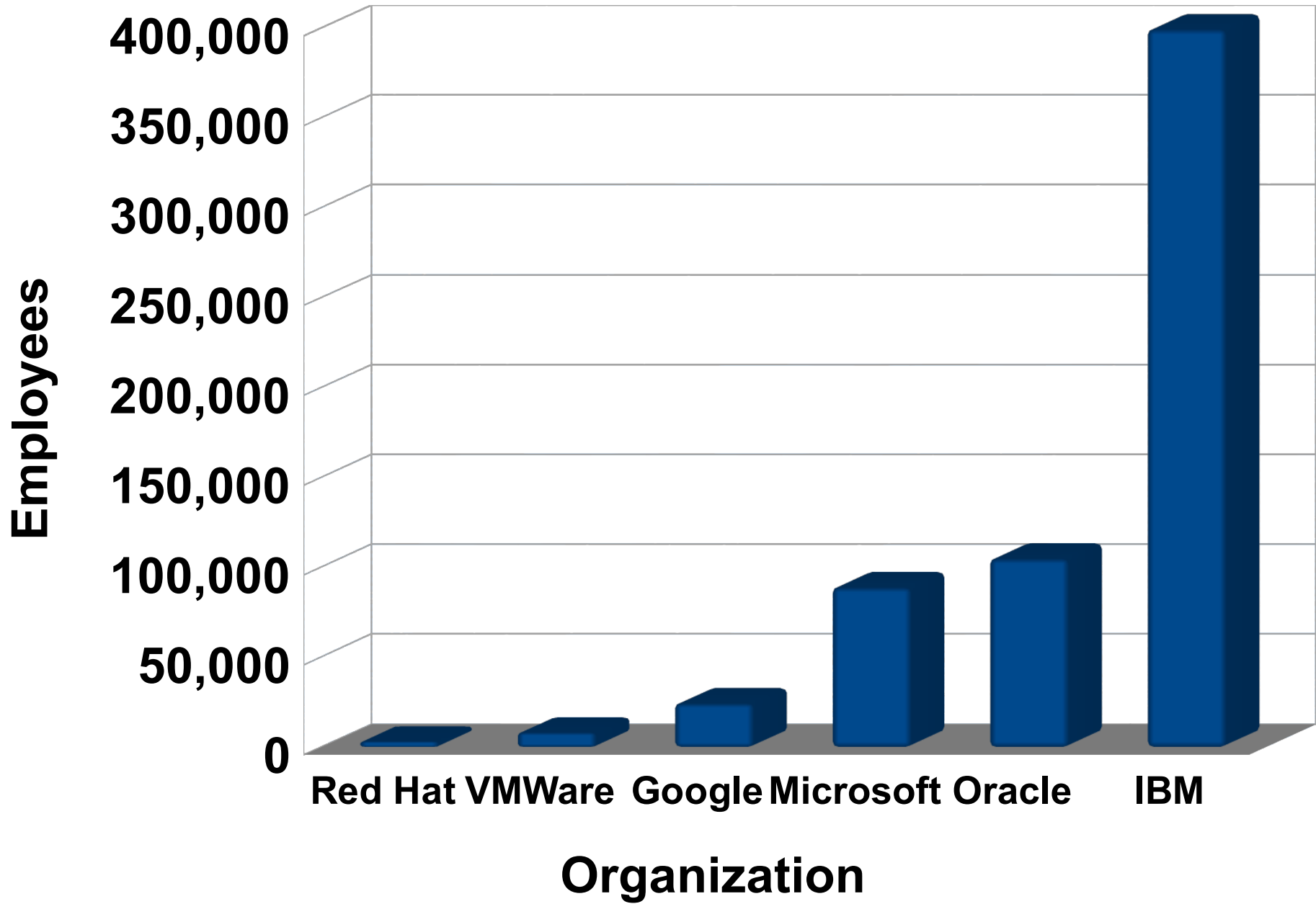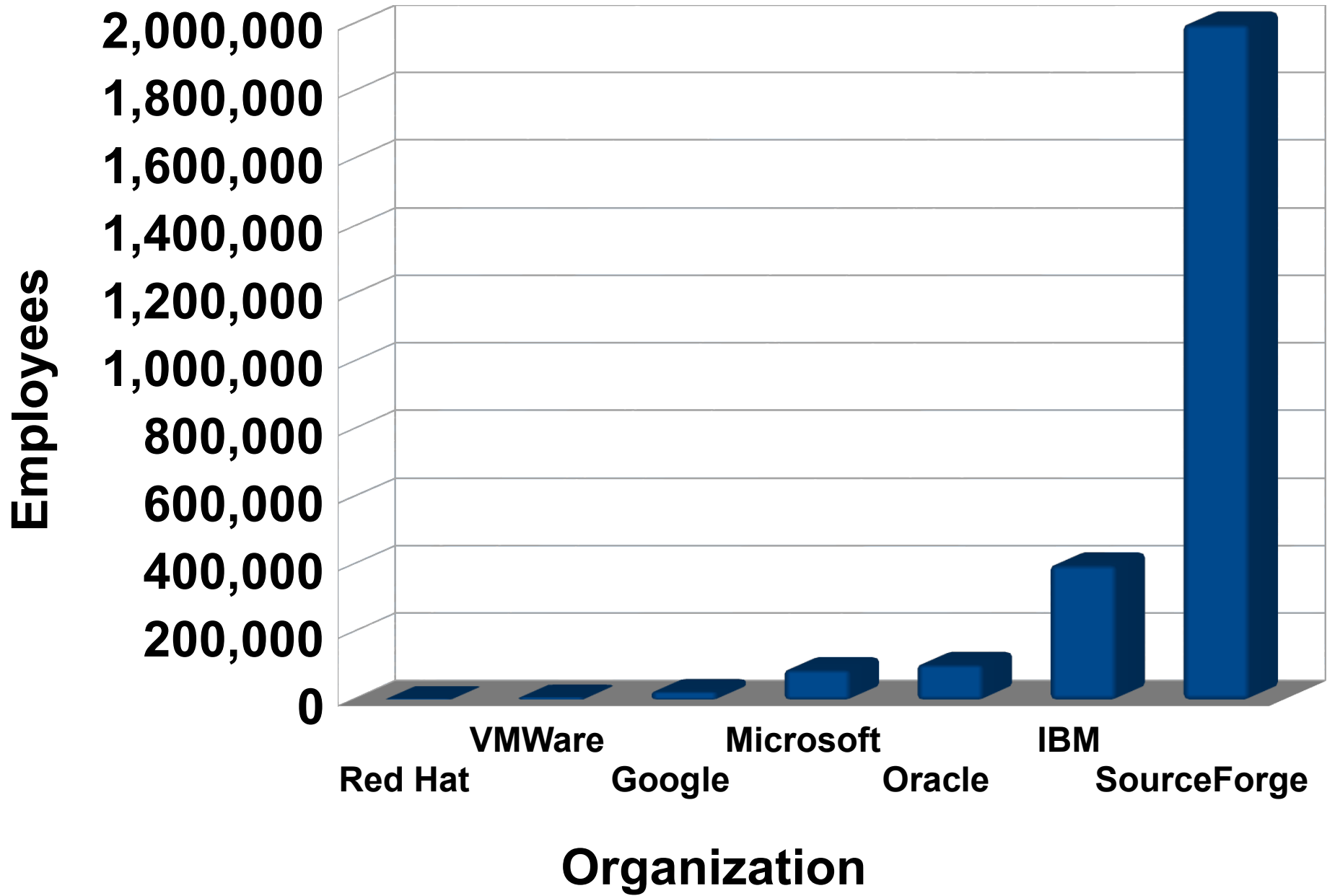
How Does Open Source Compete?
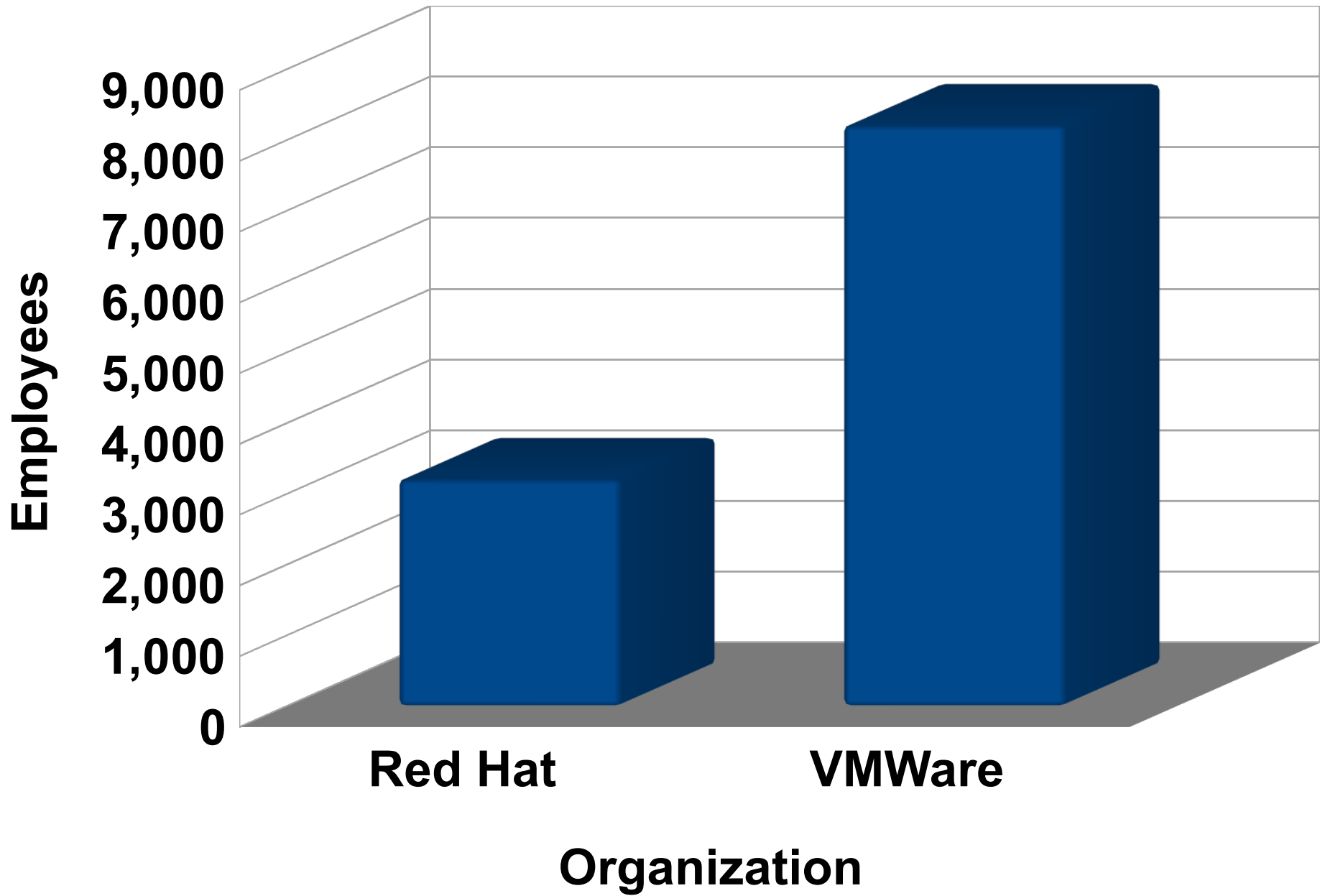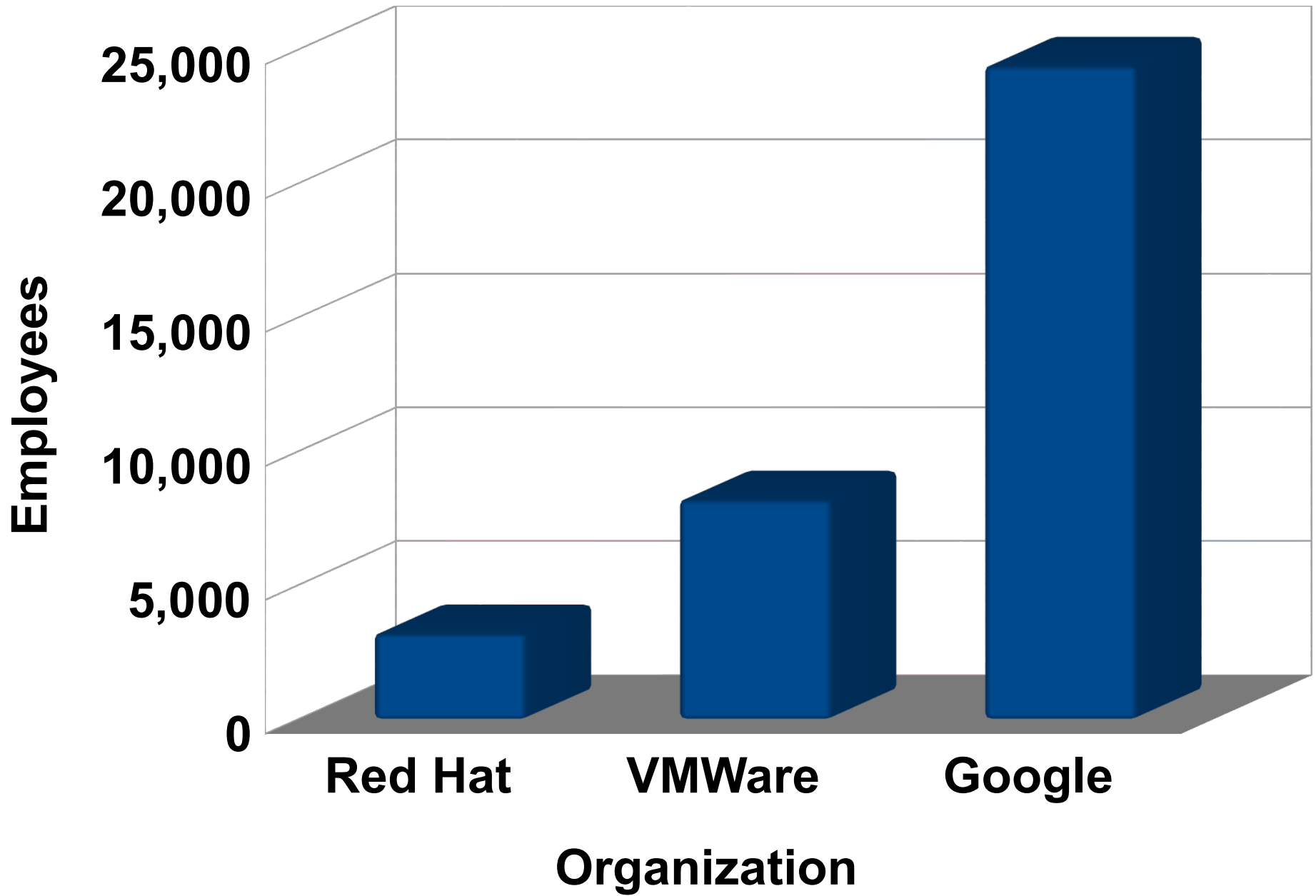
Open Source Development Models Mitigate Risk

Coverity has tracked open source code quality since 2004. They have found propriatary software, on average, has 20-30,000 defects per million lines of code. This has been true since 1960.

- 2004: Linux has 172 defects per MLOC (0.02%)

- 2005: Linux grew 4.7%, but defect density dropped to 133 defects per MLOC (0.01%)

- 2006: DHS funds study, adds LAMP stack, finds 0.01% defect density (even though 325,000+ lines of code added)

- 2009: Coverity now covers 280 projects, finds average defect density of 111 defects per MLOC
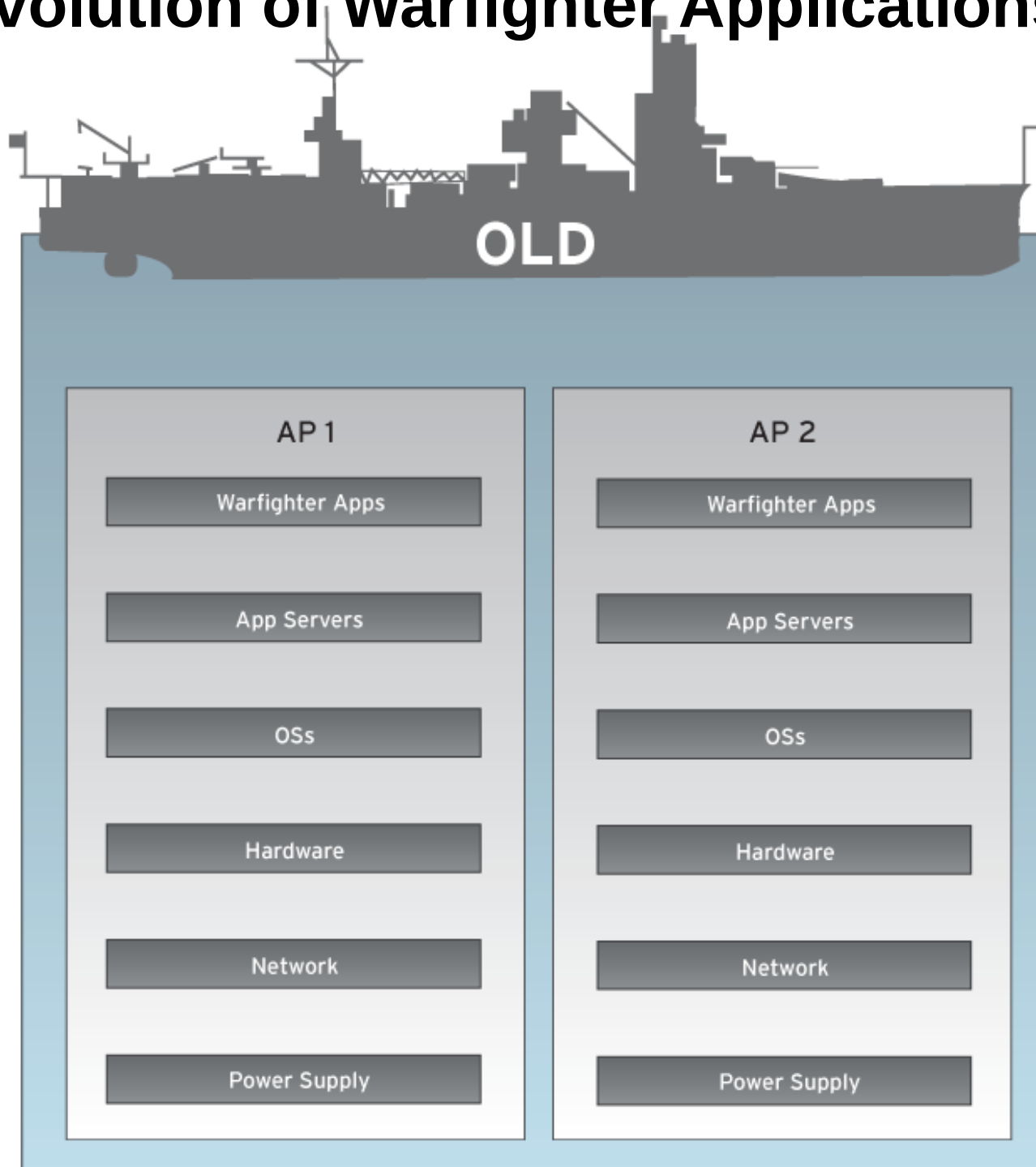*(proprietary has 20,000 to 30,000)*

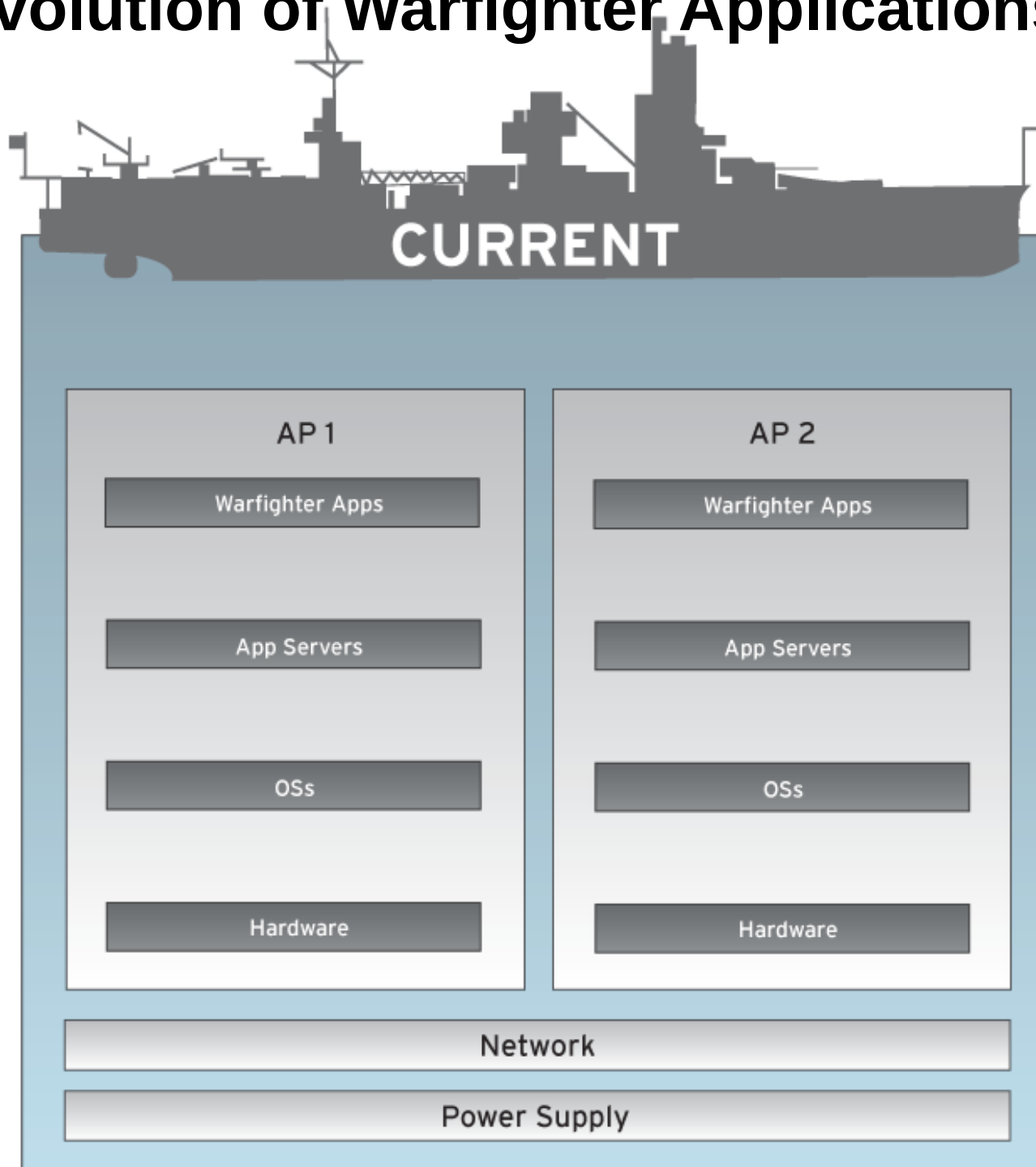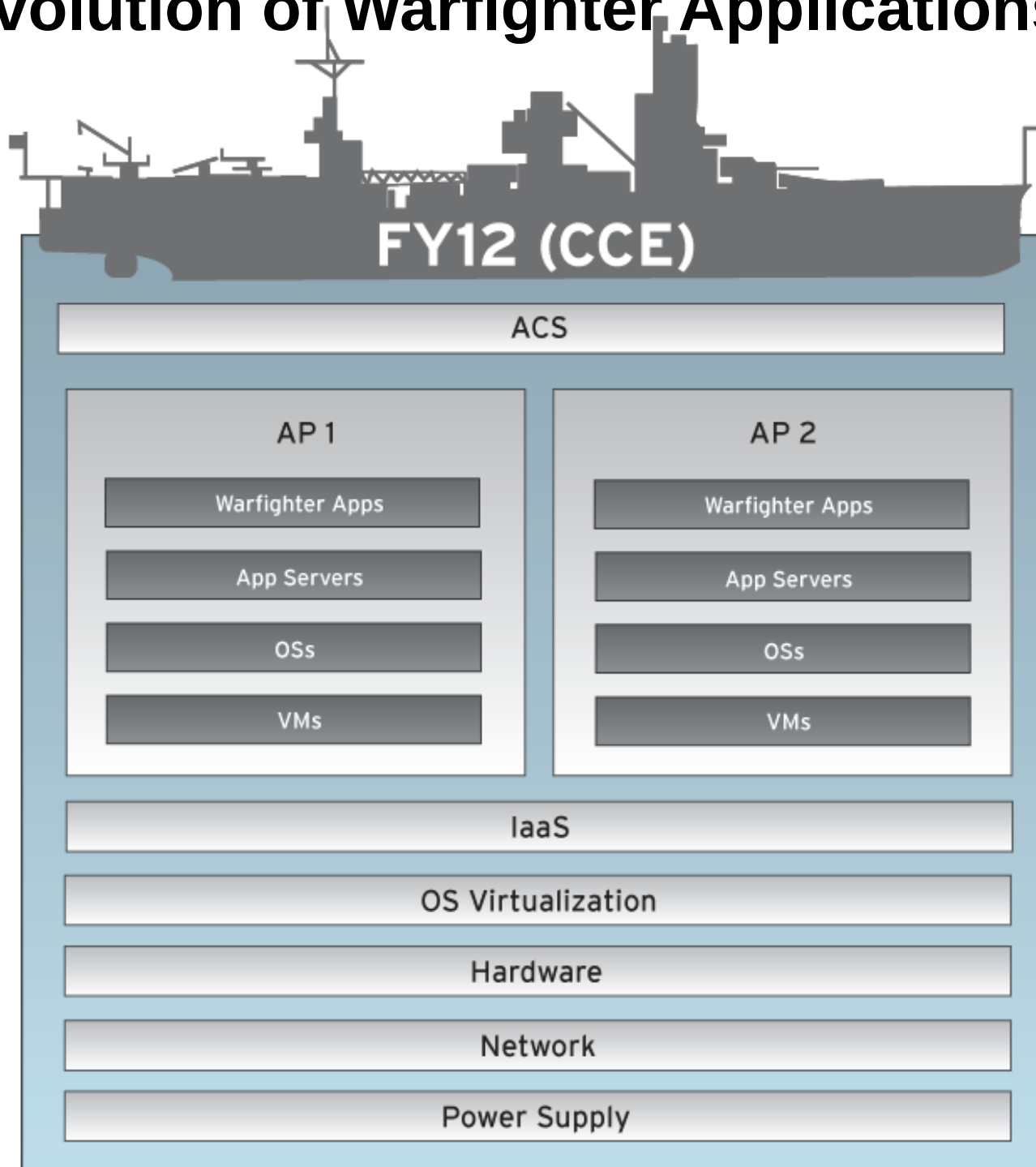# WE CAN DO MORE WHEN WE WORK TOGETHER

US Navy's standardization mission

Evolution of Warfighter Applications

OLD

AP 1

- Warfighter Apps
- App Servers
- OSs
- Hardware
- Network
- Power Supply

AP 2

- Warfighter Apps
- App Servers
- OSs
- Hardware
- Network
- Power Supply

Evolution of Warfighter Applications

CURRENT

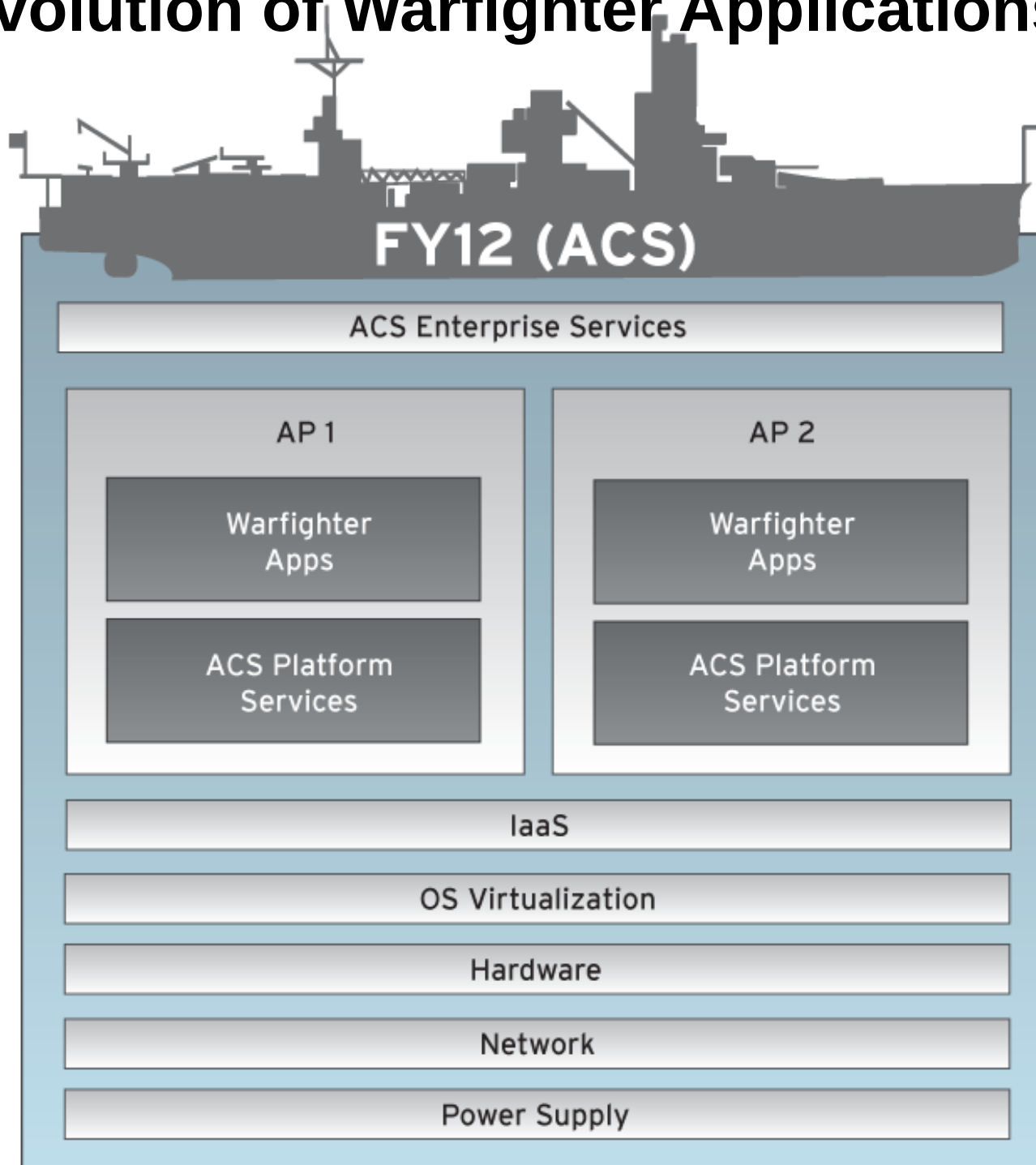| AP 1	AP 2
Warfighter Apps	Warfighter Apps
App Servers	App Servers
OSs	OSs
Hardware	Hardware

Network

Power Supply

Evolution of Warfighter Applications

Evolution of Warfighter Applications

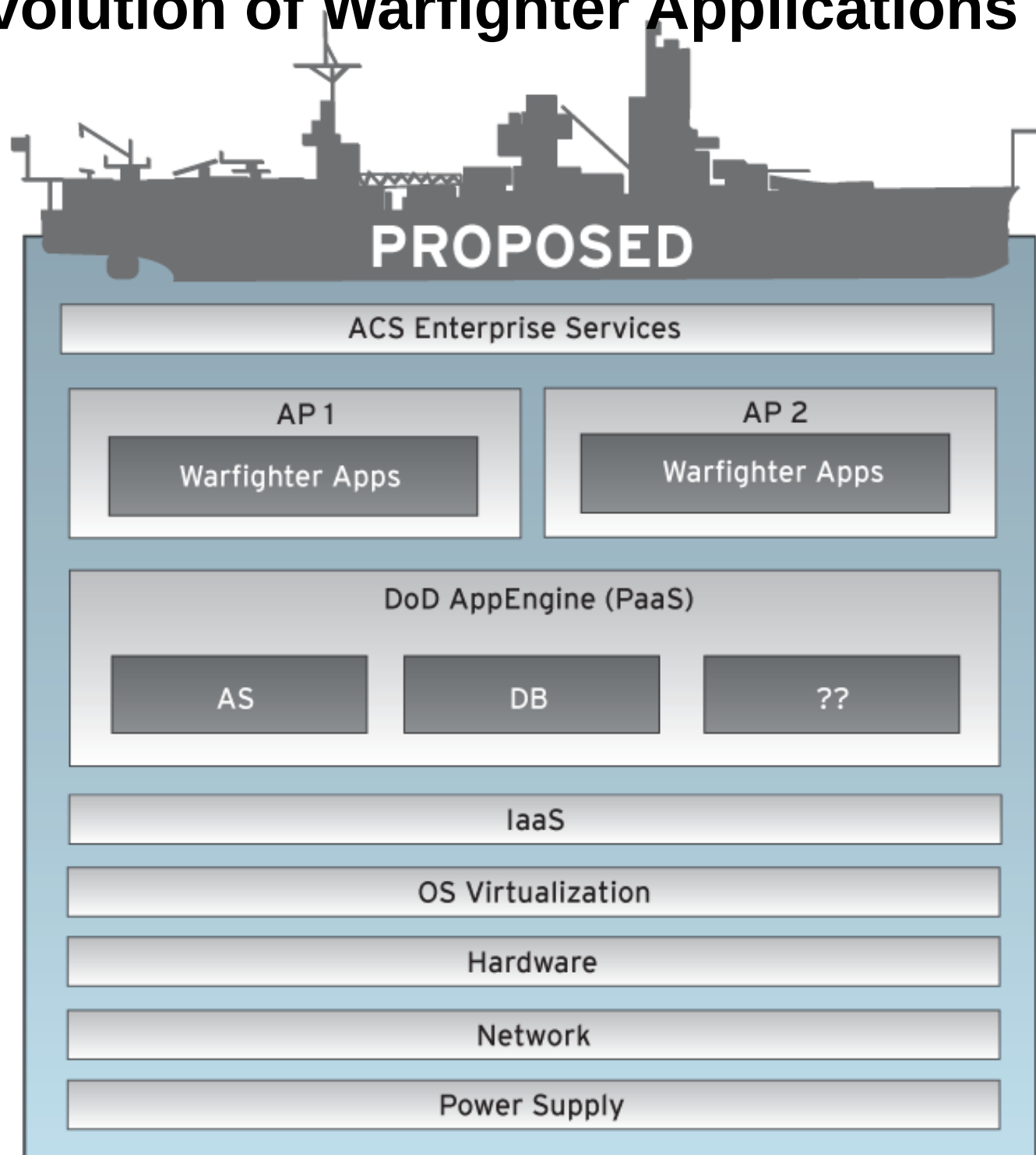| OS VIRTUALIZATION	IAAS
Provides extensive vendor tooling	Automates and removes lockin of vendor tooling
Enables live migration of VMs	Automates live migration of VMs
Allows admins to handle resource over-utilization	Automates handling resource over-utilization
Requires install and configuration of vendor products	Automates install and configuration of vendor products
Helps the admin manage the data center	Manages the data center for the admin
Red Hat Enterprise Virtualization, VMWare, Citrix	Amazon EC2

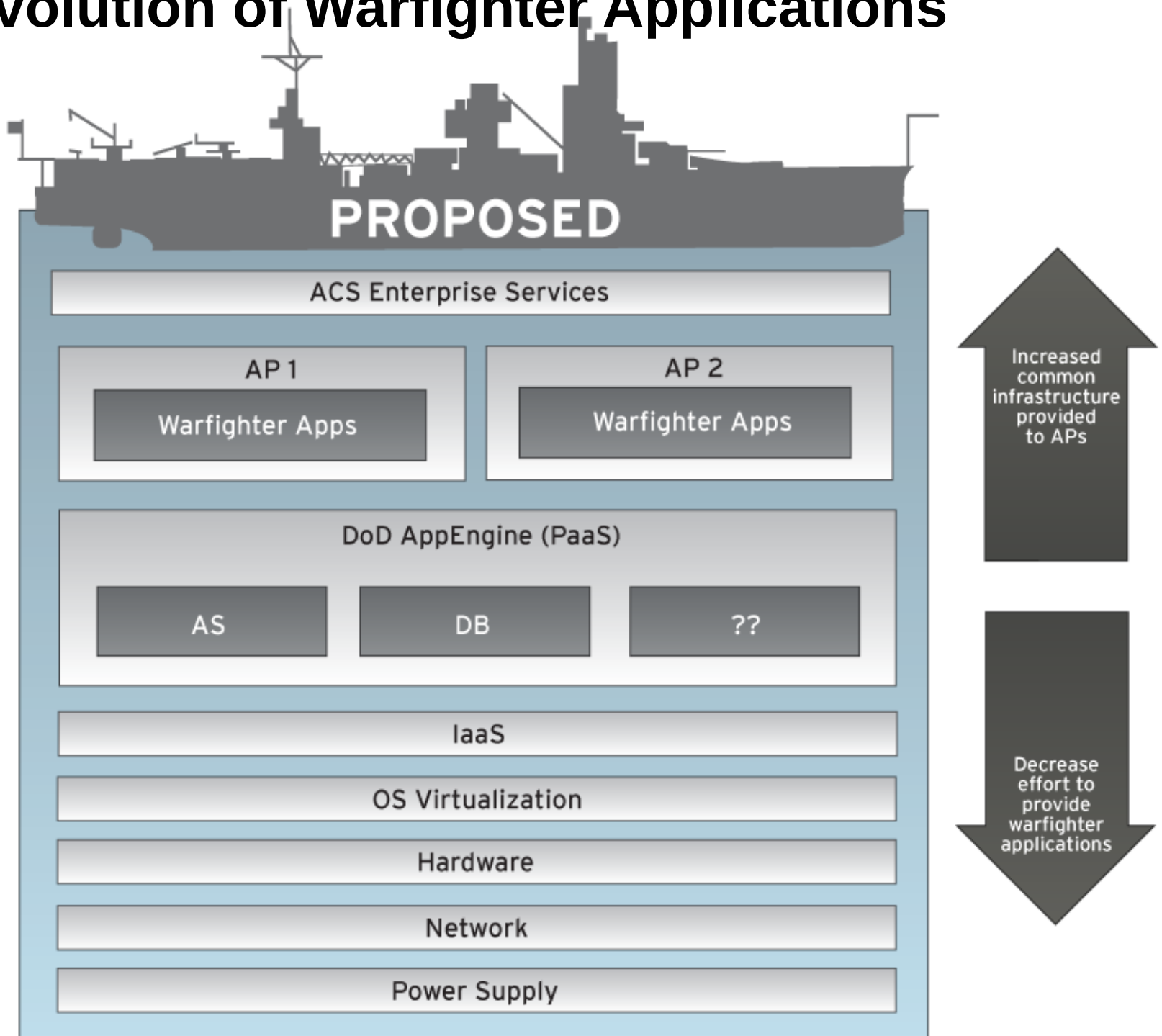# Evolution of Warfighter Applications

FY12 (ACS)

ACS Enterprise Services

AP 1	AP 2
Warfighter Apps	Warfighter Apps
ACS Platform Services	ACS Platform Services

IaaS

OS Virtualization

Hardware

Network

Power Supply

Evolution of Warfighter Applications

PLATFORM SERVICES	PAAS
App providers build to vendor products	App providers build to DoD standard
Changing middleware vendor requires work from all app providers	Changing middleware vendor is invisible to all app providers
Static scaling	Dynamic scaling
Makes it easier for app providers to build C&A'd environments	Removes need for app provider to build C&A'd environments
Build / deploy apps in months / years	Build / deploy apps in days
RHEL+JBoss, Windows+BEA Solaris+Oracle	Google AppEngine

Evolution of Warfighter Applications

PROPOSED

ACS Enterprise Services

AP 1
Warfighter Apps

AP 2
Warfighter Apps

DoD AppEngine (PaaS)

AS | DB | ??

IaaS

OS Virtualization

Hardware

Network

Power Supply

Evolution of Warfighter Applications

PROPOSED

| ACS Enterprise Services |

| AP 1 | AP 2 |
| Warfighter Apps | Warfighter Apps |

DoD AppEngine (PaaS)

| AS | DB | ?? |

| IaaS |
| OS Virtualization |
| Hardware |
| Network |
| Power Supply |

Increased common infrastructure provided to APs

Decrease effort to provide warfighter applications

KVM SPECvirt Scalability & Performance

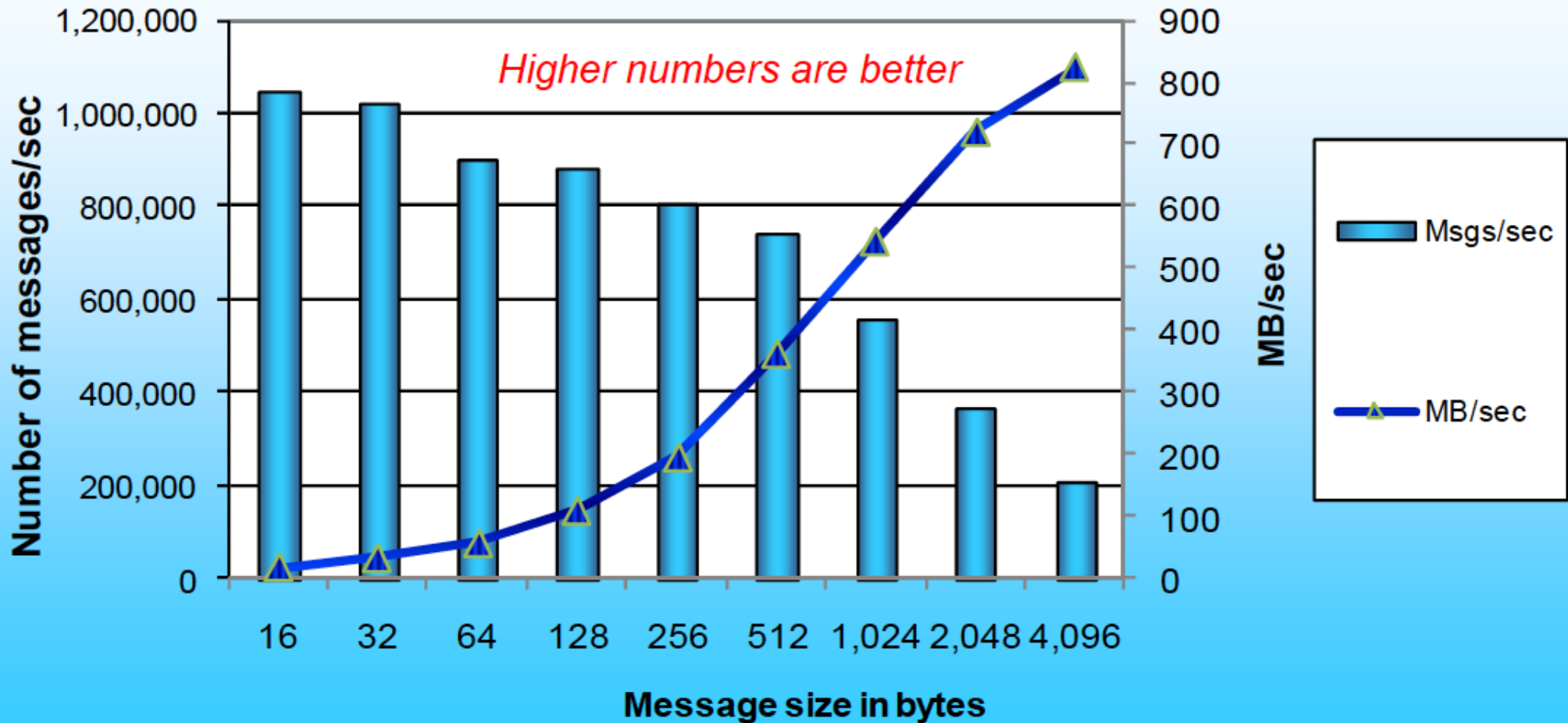| # Cores	Leading Propriatary SPECvirt2010	RHEL(KVM) SPECvirt2010 Score
12	1221@78	1367@84
16	-	1763@108
20	1811@114	2144@132
32	2742@168	N/A
40	3723@228	3802@234
64	N/A	5466@336
80	N/A	7067@432

Perftest results on RHEL KVM with PCI passthrough running two guests
Messages per second and MB per second

- Capable of 1B+ messages 14 minutes
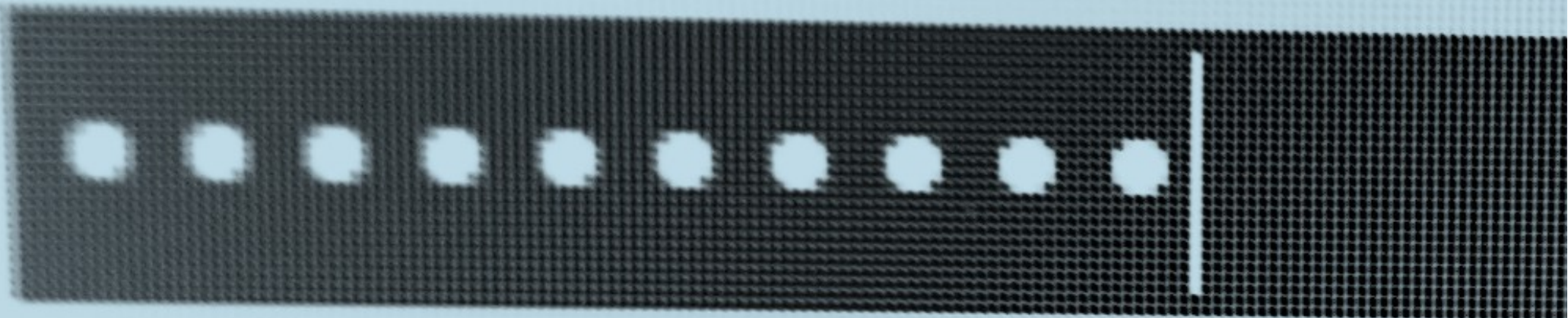- JPMorgan only sends ~1B AMQP messages **per day**
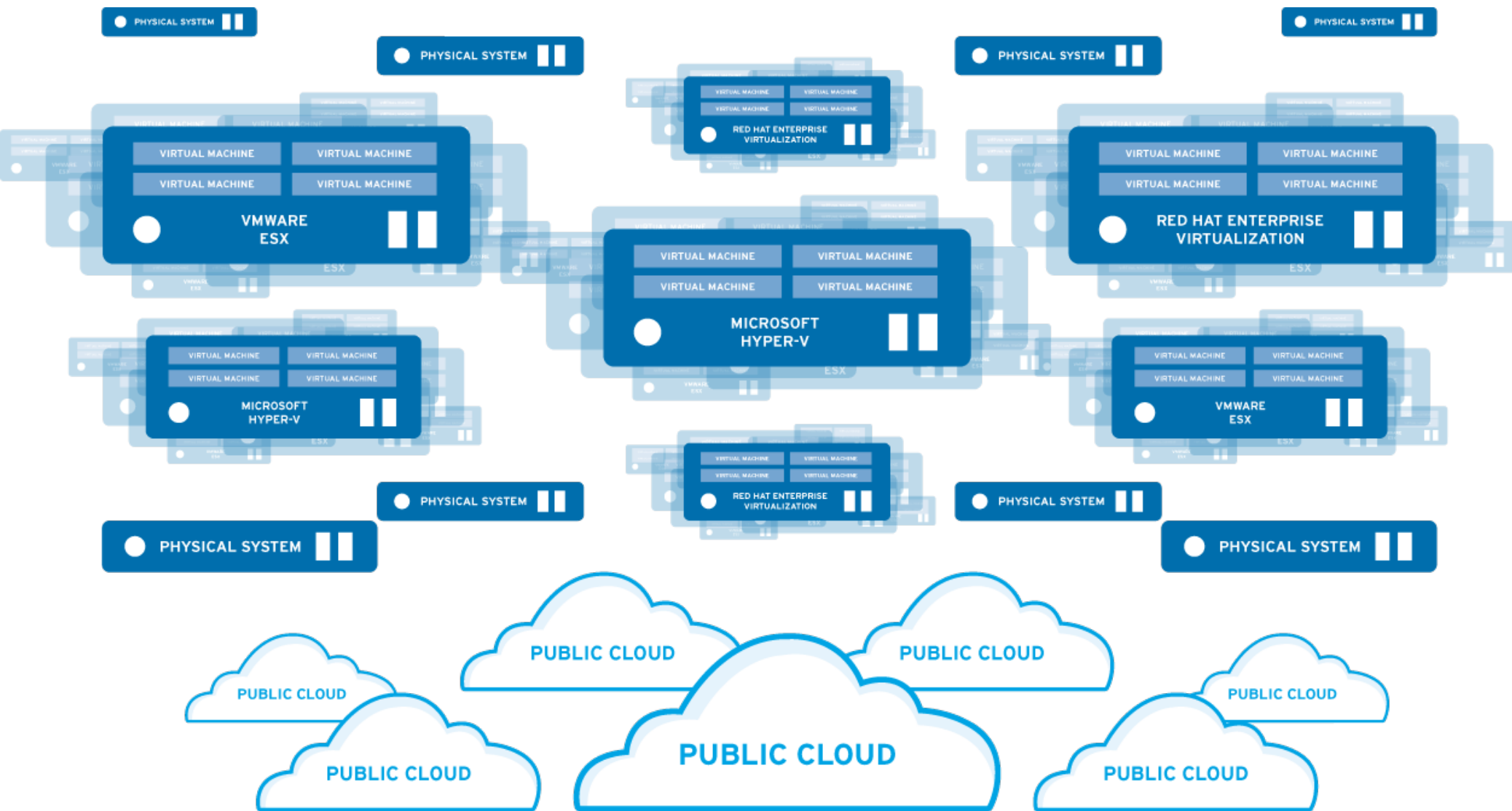
The NSA's security challenge

Included Security Controls

- Type 1 vs Type 2 (classified as Type 1 by the IC)

- Common Criteria (CAPP, RBAC, LSPP)

- sVirt

- Certifiable Linux Integration Project (CLIP)
  - DCID 6/3 PL4
  - NSS 1253
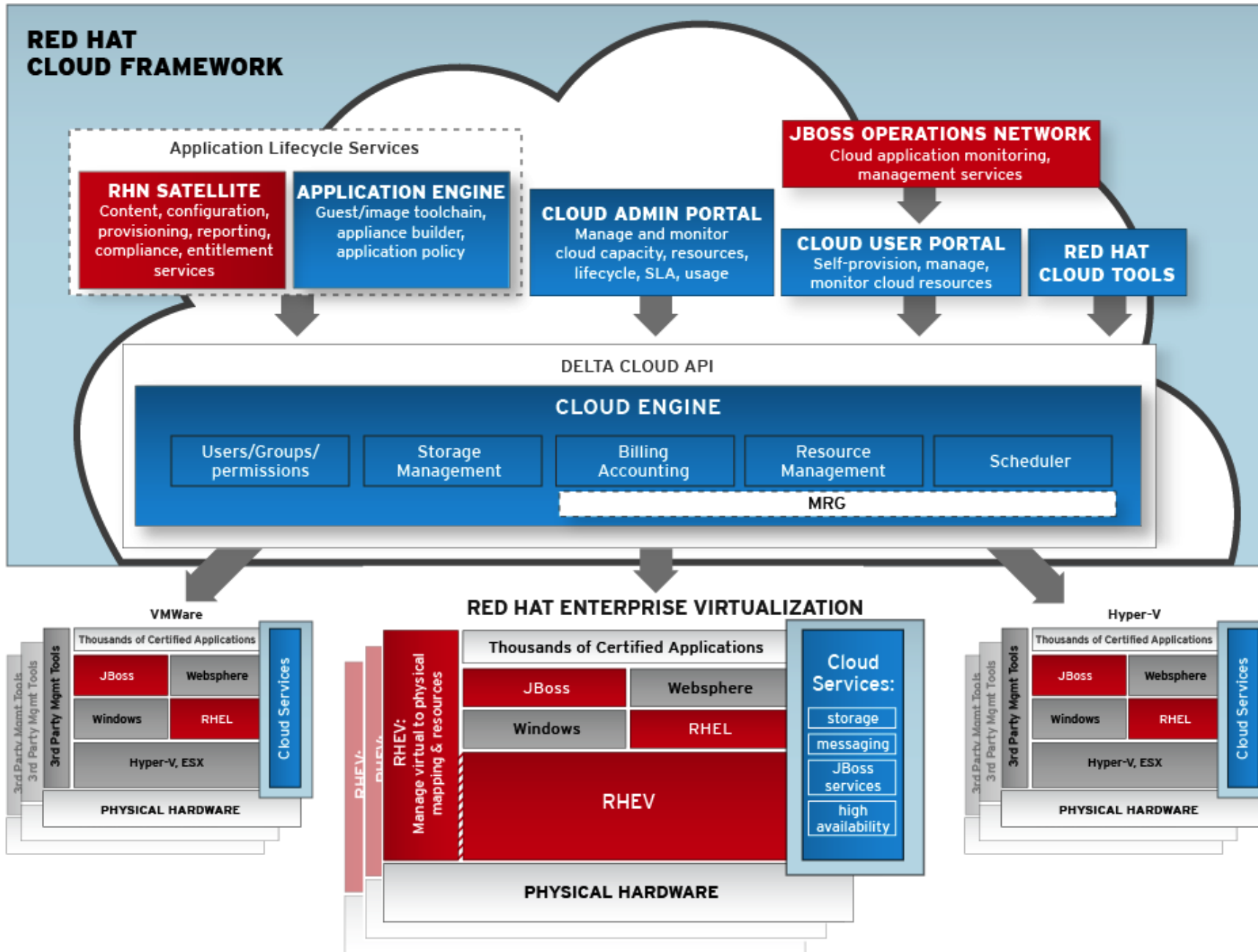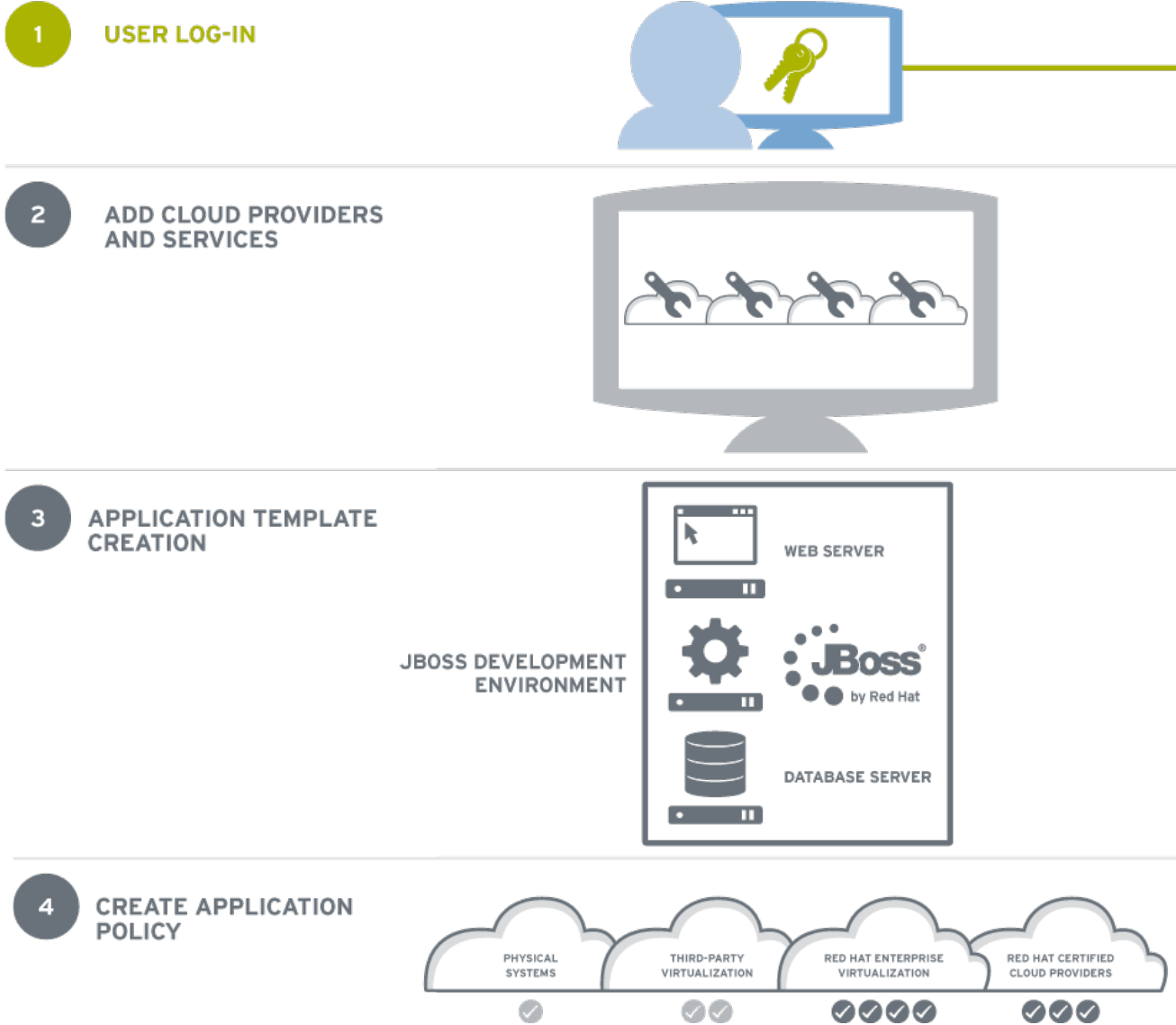 - DOD 8500.2
  - DISA STIG V5R1
  - http://oss.tresys.com/projects/clip

What's the Current Problem?

Red Hat Cloud Foundations

ADMINS BUILD PRIVATE PAAS

BUILD AND MANAGE CLOUDS

1 USER LOG-IN

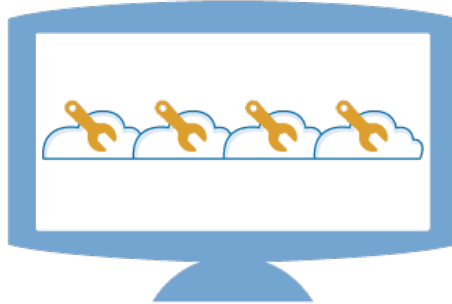**2** ADD CLOUD PROVIDERS AND SERVICES

3 APPLICATION TEMPLATE CREATION

JBOSS DEVELOPMENT ENVIRONMENT

WEB SERVER

JBoss® by Red Hat

DATABASE SERVER

4 CREATE APPLICATION POLICY

PHYSICAL SYSTEMS

THIRD-PARTY VIRTUALIZATION

RED HAT ENTERPRISE VIRTUALIZATION

RED HAT CERTIFIED CLOUD PROVIDERS

CLOUDFORMS DELIVERS IAAS

APPLICATION LIFECYCLE MANAGEMENT

SYSTEM ENGINE   APPLICATION ENGINE

COMPUTE RESOURCE MANAGEMENT

1 ADMIN PORTAL   SELF-SERVICE PORTAL

DELTA CLOUD API

CLOUD ENGINE

INFRASTRUCTURE SERVICES

PHYSICAL SYSTEMS   STORAGE   MESSAGING   PUBLIC CLOUD

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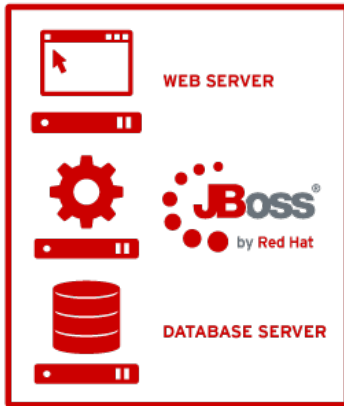**3** APPLICATION TEMPLATE CREATION

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JBoss® by Red Hat

DATABASE SERVER

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DELTA CLOUD API

CLOUD ENGINE

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4 CREATE APPLICATION POLICY

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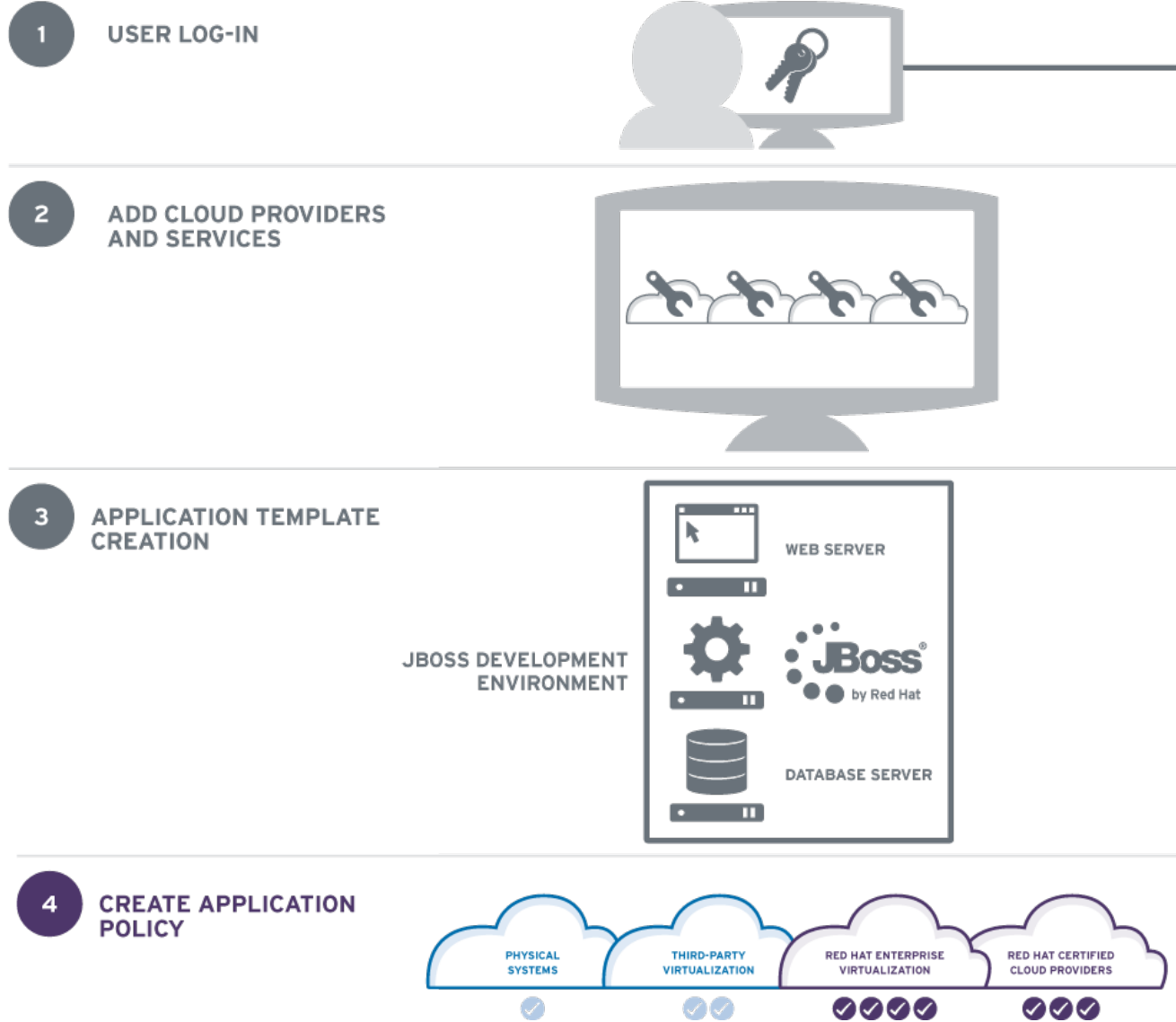**3** APPLICATION TEMPLATE CREATION

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COMPUTE RESOURCE MANAGEMENT

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STORAGE | MESSAGING

VIRTUALIZATION

PUBLIC CLOUD

45

DEVELOPERS USE PRIVATE PAAS

BUILD, MANAGE, AND LAUNCH APPLICATIONS

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2 USER SELF-SERVICE TEMPLATE SELECTION IMAGE CREATION
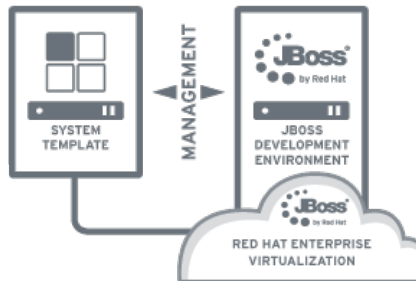Provided by Application Engine
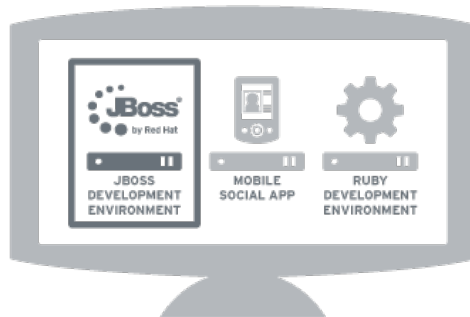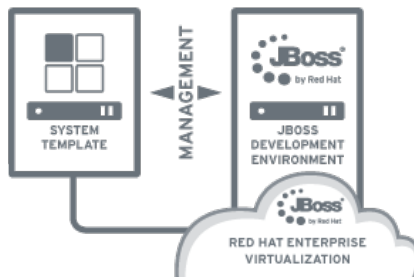
JBoss by Red Hat

- JBOSS DEVELOPMENT ENVIRONMENT
- MOBILE SOCIAL APP
- RUBY DEVELOPMENT ENVIRONMENT

3 AUTOMATED DEPLOYMENT UNDER POLICY
Provided by Cloud Engine

- PHYSICAL SYSTEMS
- THIRD-PARTY VIRTUALIZATION
- RED HAT ENTERPRISE VIRTUALIZATION (JBoss)
- RED HAT CERTIFIED CLOUD PROVIDERS

4 OPERATIONAL CONTROL AND CONTINUOUS COMPLIANCE
Provided by System Engine

- SYSTEM TEMPLATE
- MANAGEMENT
- JBOSS DEVELOPMENT ENVIRONMENT (JBoss)
- RED HAT ENTERPRISE VIRTUALIZATION (JBoss)

CLOUDFORMS DELIVERS IAAS

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IMAGE CREATION
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JBOSS DEVELOPMENT ENVIRONMENT

MOBILE SOCIAL APP

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48

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3 AUTOMATED DEPLOYMENT
UNDER POLICY
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4 OPERATIONAL CONTROL AND
CONTINUOUS COMPLIANCE
Provided by System Engine

JBoss by Red Hat
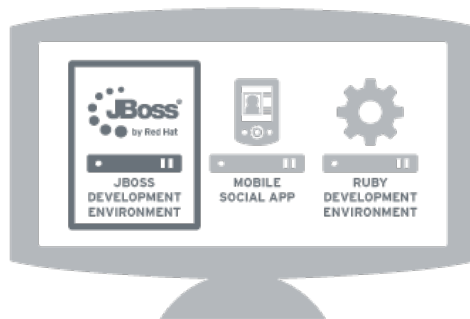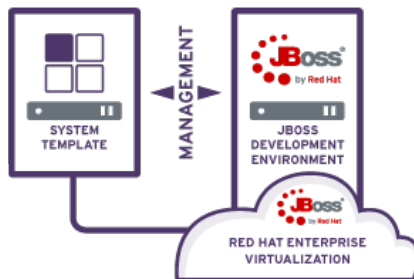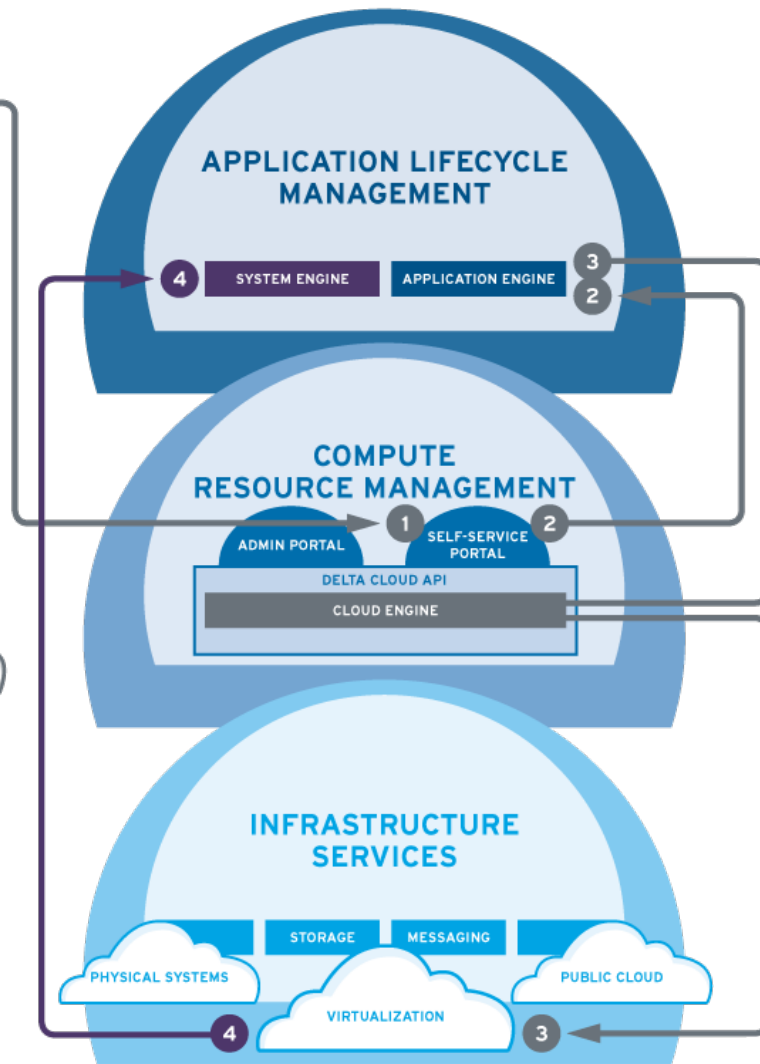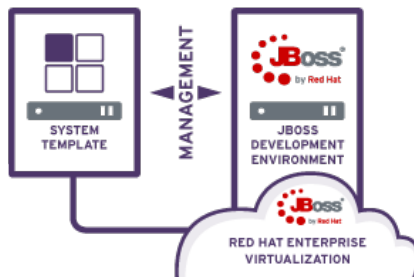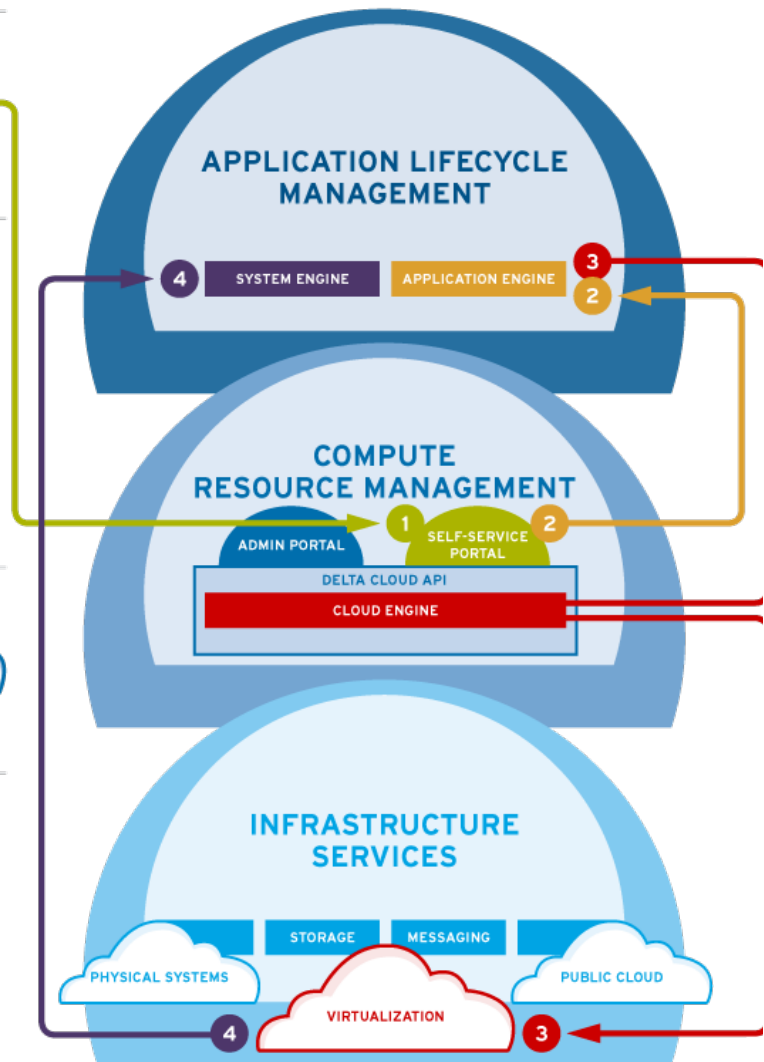JBOSS DEVELOPMENT ENVIRONMENT

MOBILE SOCIAL APP

RUBY DEVELOPMENT ENVIRONMENT

PHYSICAL SYSTEMS

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RED HAT ENTERPRISE VIRTUALIZATION

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SYSTEM TEMPLATE

MANAGEMENT

JBoss by Red Hat
JBOSS DEVELOPMENT ENVIRONMENT

JBoss by Red Hat
RED HAT ENTERPRISE VIRTUALIZATION

APPLICATION LIFECYCLE MANAGEMENT

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COMPUTE RESOURCE MANAGEMENT

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STORAGE MESSAGING

PHYSICAL SYSTEMS

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4 VIRTUALIZATION **3**

BUILD, MANAGE, AND LAUNCH APPLICATIONS

CLOUDFORMS DELIVERS IAAS

1 **USER LOG-IN**

2 **USER SELF-SERVICE
TEMPLATE SELECTION
IMAGE CREATION**

Provided by Application Engine

JBoss by Red Hat

JBOSS DEVELOPMENT ENVIRONMENT

MOBILE SOCIAL APP

RUBY DEVELOPMENT ENVIRONMENT

3 **AUTOMATED DEPLOYMENT
UNDER POLICY**

Provided by Cloud Engine

PHYSICAL SYSTEMS

THIRD-PARTY VIRTUALIZATION

JBoss by Red Hat
RED HAT ENTERPRISE VIRTUALIZATION

RED HAT CERTIFIED CLOUD PROVIDERS

4 **OPERATIONAL CONTROL AND
CONTINUOUS COMPLIANCE**

Provided by System Engine

SYSTEM TEMPLATE

MANAGEMENT

JBoss by Red Hat
JBOSS DEVELOPMENT ENVIRONMENT

JBoss by Red Hat
RED HAT ENTERPRISE VIRTUALIZATION

APPLICATION LIFECYCLE MANAGEMENT

4 SYSTEM ENGINE | APPLICATION ENGINE **3**
2

COMPUTE RESOURCE MANAGEMENT

ADMIN PORTAL

1 SELF-SERVICE PORTAL **2**

DELTA CLOUD API

CLOUD ENGINE

INFRASTRUCTURE SERVICES

PHYSICAL SYSTEMS

STORAGE | MESSAGING

PUBLIC CLOUD

4 VIRTUALIZATION **3**

50

WHO'S DOING THIS?

Cloud Jeopardy!

	SalesForce	Amazon	Rackspace	Google	Facebook	Microsoft
Cloud Type	SaaS	IaaS	IaaS	SaaS / PaaS	SaaS	SaaS / PaaS
Customers	55k Corp 1.5m Pers	100k+	50k+	1m+	750m+	10k+
Cloud Revenue	$1.5B	$500M	$56M	$50M	N/A	N/A

← **Open Source Providers**

RED HAT CLOUD CUSTOMERS

"Our decade-long partnership with Red Hat has always been focused on customer value and innovation. Today, we are extending this partnership to include cloud computing – broadening our reach and answering the strong customer demand for cloud computing services, Red Hat Enterprise Virtualization is an **optimal hypervisor technology for the infrastructure offerings on the IBM cloud***."*

- Maria Azua, VP Cloud Computing Enablement at IBM

RED HAT CLOUD CUSTOMERS

*"Red Hat gets it. **In kernel virtualization, virtualization management, the application orchestration and cloud abstraction layers, Red Hat gets it**. Red Hat is giving customers the opportunity to innovate [in different ways] and leverage them where it makes sense."*

- Derek Chan, Digital Operations, DreamWorks

"At DreamWorks Animation, cutting-edge technology is a key enabler to our creative ambition. **Red Hat's Cloud Foundations provides a compelling platform to enable our cloud strategy** giving us the ability to quickly scale our compute needs to meet the demands of our productions."
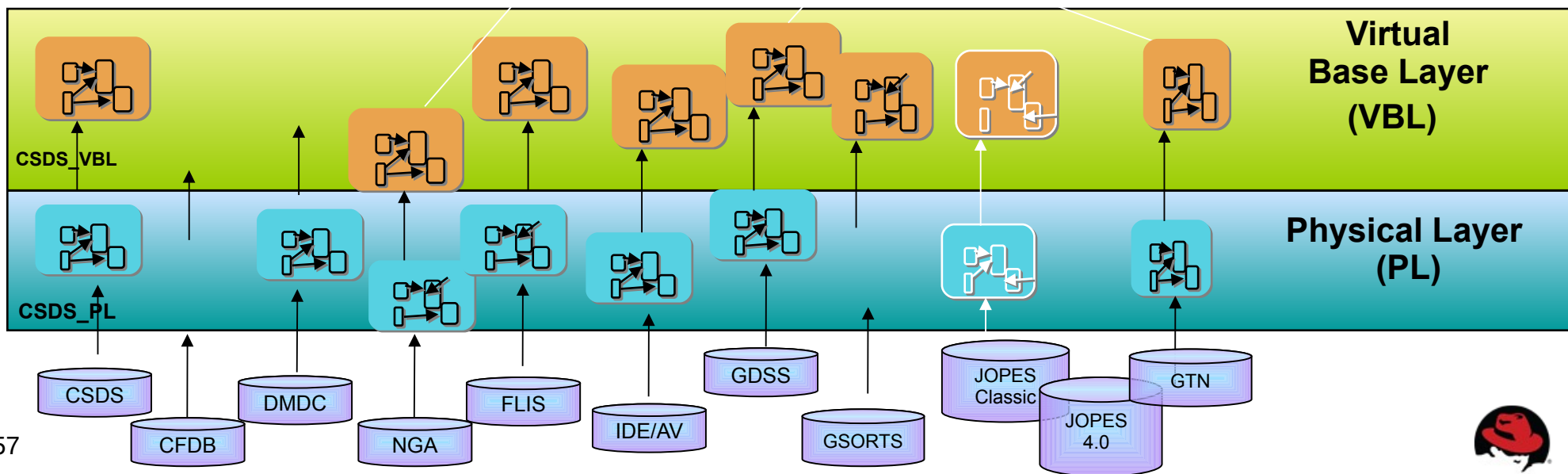
— Ed Leonard, DreamWorks Animation's CTO

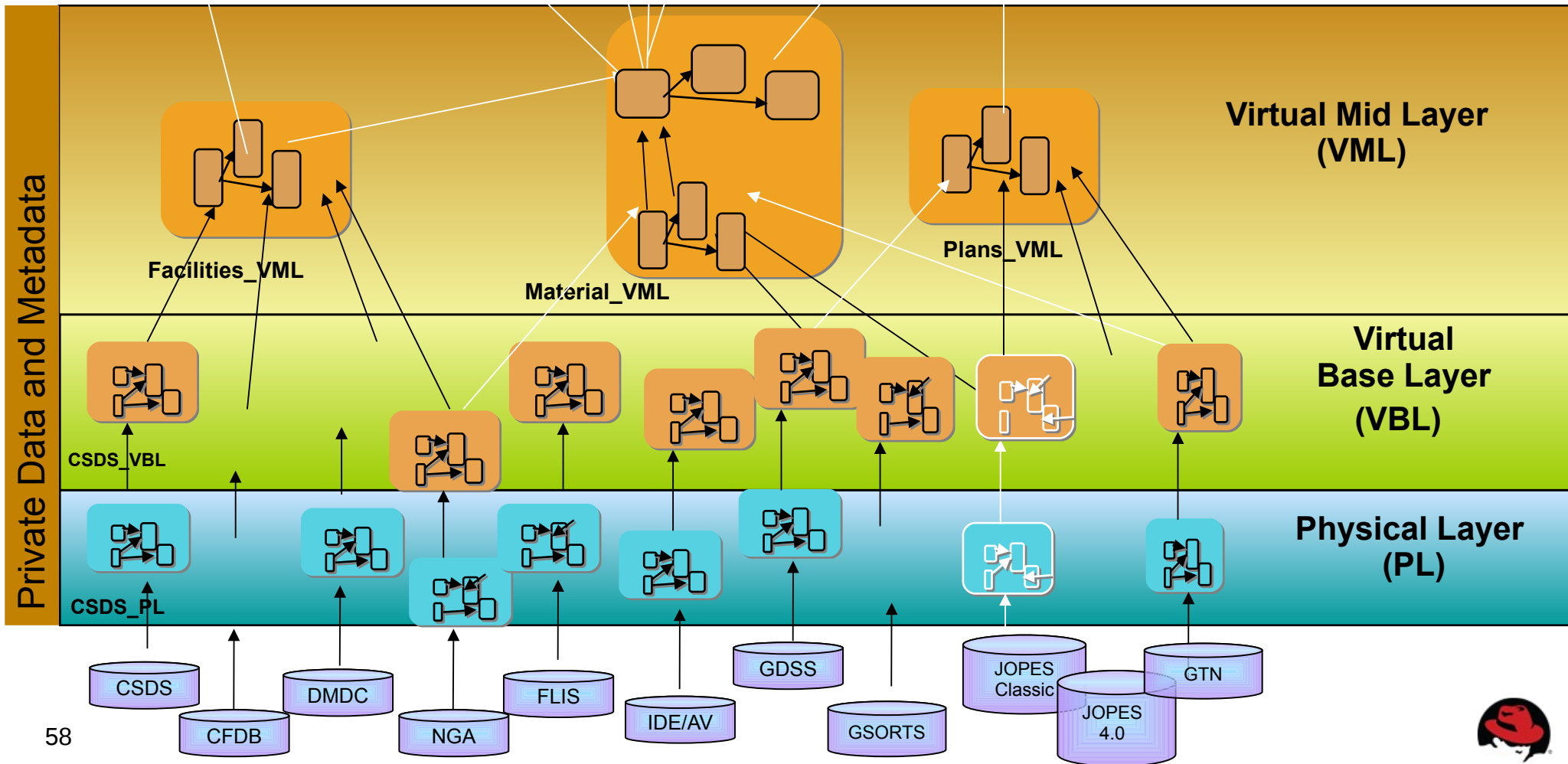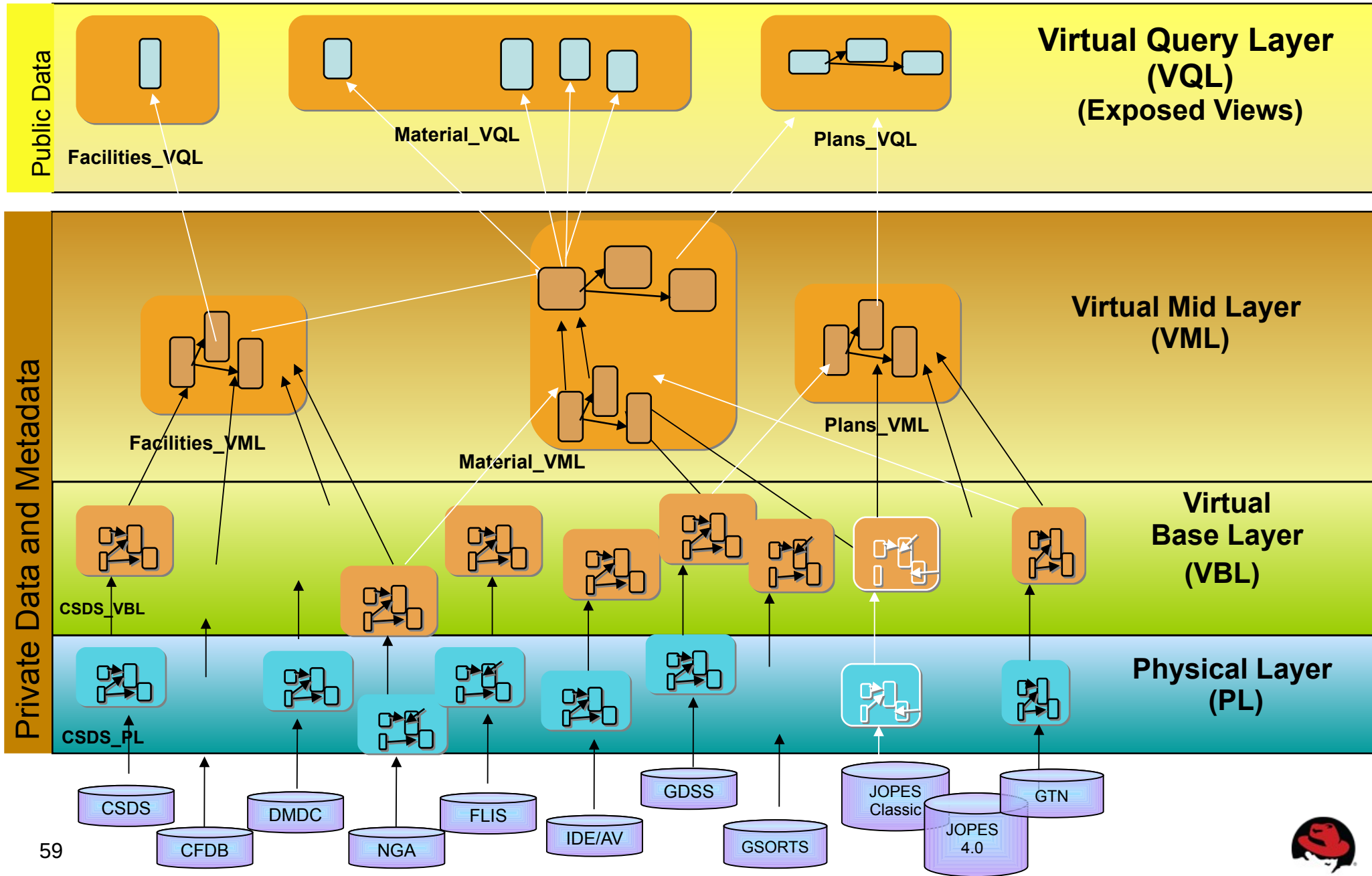# What About the Data?

Structured Data Services

Physical Layer (PL)

CSDS_PL

CSDS

CFDB

DMDC

NGA

FLIS

IDE/AV

GDSS

GSORTS

JOPES Classic

JOPES 4.0

GTN

Structured Data Services

Virtual Base Layer (VBL)

Physical Layer (PL)

CSDS_VBL

CSDS_PL

CSDS
CFDB
DMDC
NGA
FLIS
IDE/AV
GDSS
GSORTS
JOPES Classic
JOPES 4.0
GTN

Structured Data Services

Virtual Mid Layer (VML)

Facilities_VML

Material_VML

Plans_VML

Virtual Base Layer (VBL)

CSDS_VBL

Physical Layer (PL)

CSDS_PL

Private Data and Metadata

CSDS
CFDB
DMDC
NGA
FLIS
IDE/AV
GDSS
GSORTS
JOPES Classic
JOPES 4.0
GTN

58
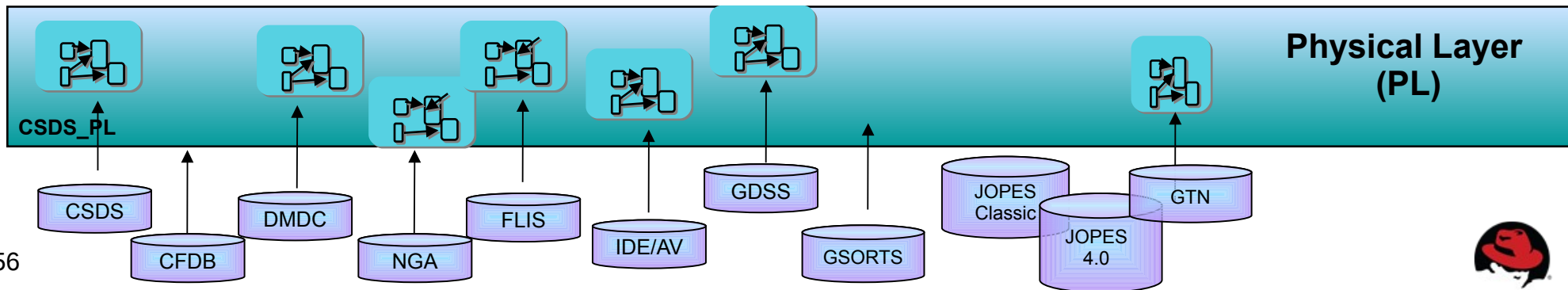
Structured Data Services

DISA ADNET: Anti-Drug Network

Challenge

- Counter-narcotics and counter-narcoterrorism
- Statutory detection and monitoring
- Data is heterogenous & on multiple systems

Solution

- MetaMatrix provides an abstracted view across multiple State/Local Law enforcement agencies.
- The virtual Database enables BI tools to get a complete picture of a "person of interest" from any history, warrants, jail, crimes, vehicles, etc...
- Also, MM is used as a federated search layer looking for possible persons of interest given general details (cars, addresses, license, aliases, etc...)

Benefit

- Enable ADNET to deliver on its mission

BI tools, Portal, Federated Search

Data Services Platform

Data Service
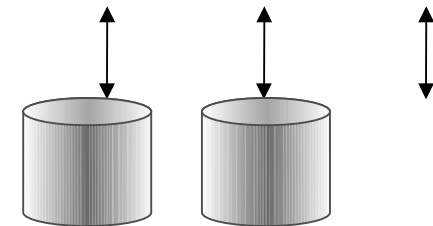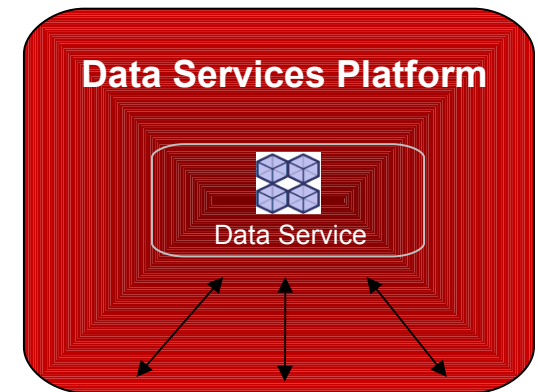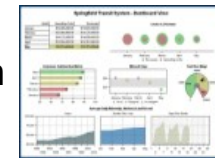
Disparate, heterogenous State/Local databases
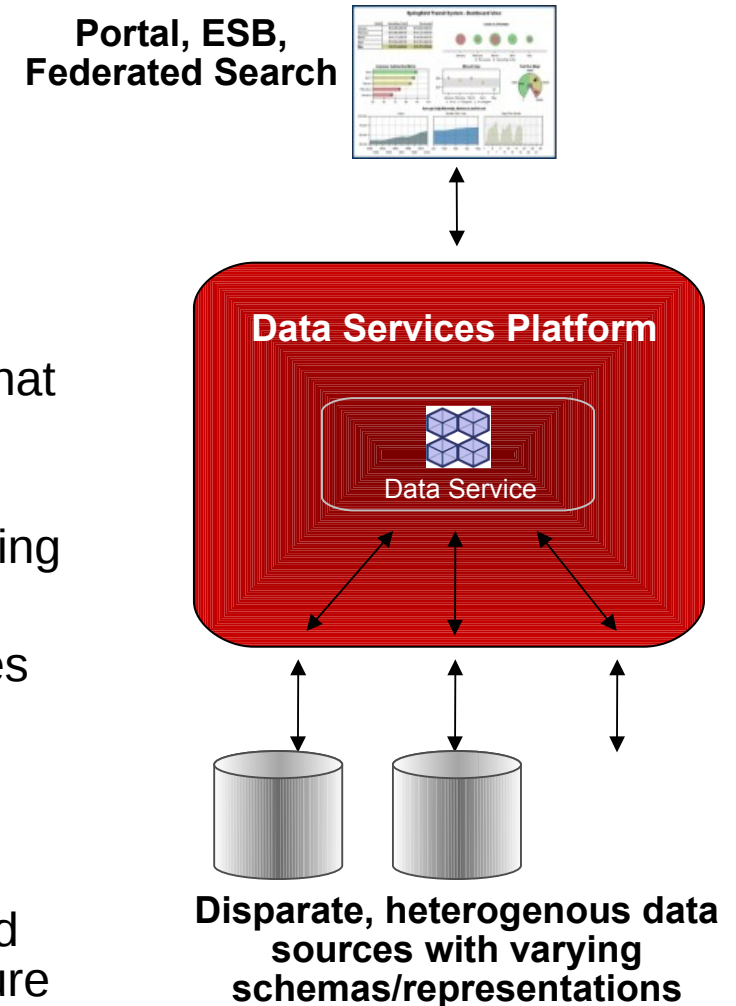
IC Persons of Interest

Challenge

- Need to find Person of Interest among disparate systems
- Adherence/mapping to common schema
- Data integration for SOA enablement

Solution

- Created abstracted view of a Enterprise Schema that is focused on Master Data Entities (Domains) like Person, Organizations, etc.
- Provide data services layer of the SOA stack, feeding the ESB
- ESB facilitates sync/async capabilities and provides integrated enterprise data efficiently and rapidly to multiple consumers

Benefit

- Simplified data access and decoupled services and apps from the underlying complex data infrastructure
- Single view of data enables migration of external sources into the Enterprise repository seamlessly and without application impact

Portal, ESB, Federated Search

Data Services Platform

Data Service

Disparate, heterogenous data sources with varying schemas/representations

How Can the Government (and the IC) Get Involved?

Efforts at NGA

> ## Taking Ownership of IT Infrastructure Through Open Source Technology (OST)
>
> ### Background
>
> The National Geospatial-Intelligence Agency (NGA) depends upon a very large and steadily growing array of technologies – hardware, software, and complex information systems – to discover, collect, store, manage, process, and deliver raw data, intermediate products, finished intelligence, and related value-added services for customers, partners, and other national security stakeholders. This infrastructure currently consumes a significant portion of NGA's annual budget to develop and maintain, a cost which continues to grow. While infrastructure costs continue to increase, the Government at large is facing future budgets cuts. If current trends continue, the costs to maintain the enterprise will exceed even the most liberal resource projections. Therefore, we need to reduce expenditures in order to execute the vision for on-line, on-demand access to all GEOINT and a fresh transformation of the analysis process. It is clear today to the senior leadership that a significant comprehensive change is urgently required.

- NGA Project Executive: Bert Beaulieu (InnoVision)
- NGA Project Manager: Michael W. Cline