Romney White – z Systems Architecture and Technology

z Systems in a Mobile World

The role of z Systems in your mobile strategy

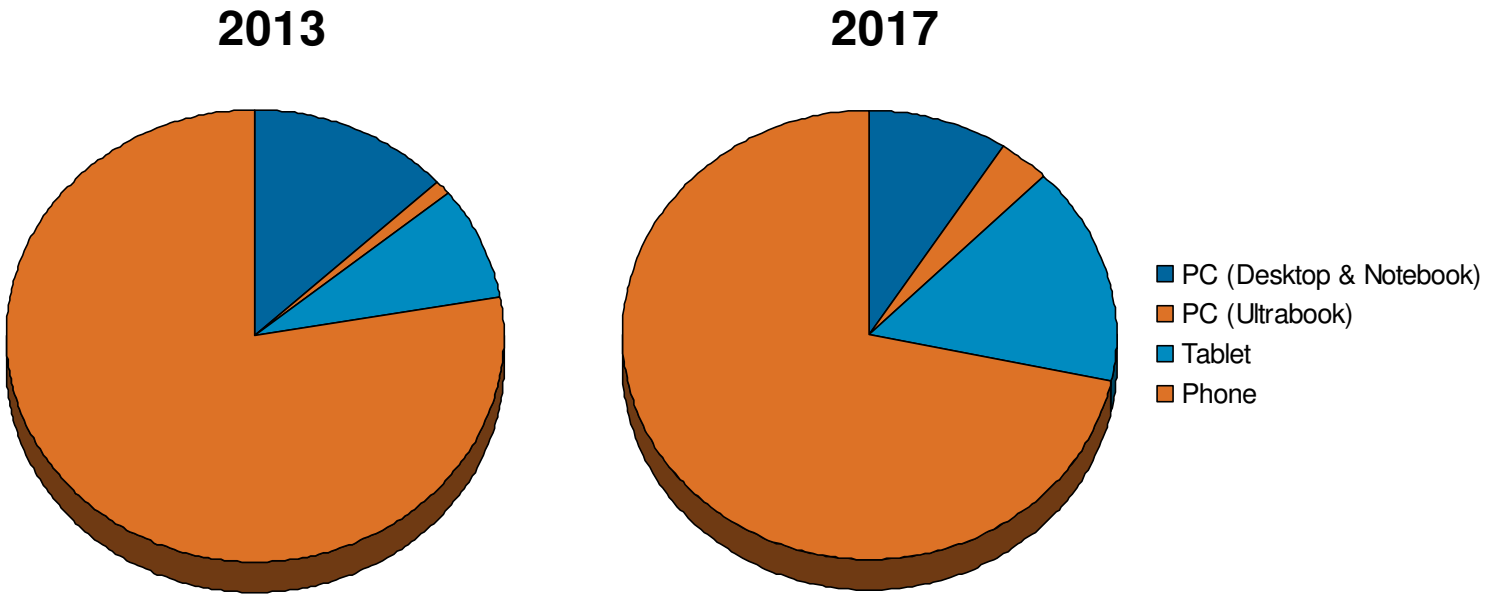
As enterprises work to gain control of the challenging mobile environment, z Systems has a key role in hosting mobile applications, both as a System of Record, and as a System of Engagement.

Agenda

- Enterprise mobile challenges
- IBM MobileFirst
- z Systems role in Mobile Applications
- IBM Worklight on z Systems
- CICS, IMS, and DB2 are ready for mobile
- Why Mobile on z Systems
- Getting started

Mobile Devices are 80% of those sold to access the Internet

Worldwide Shipment of Devices to Access the Internet



Worldwide Devices Shipments by Segment (Thousands of Units)

Device Type	2012	2013	2014	2017
PC (Desk-Based and Notebook)	341,263	315,229	302,315	271,612
PC (Ultrabooks)	9,822	23,592	38,687	96,350
Tablet	116,113	197,202	265,731	467,951
Mobile Phone	1,746,176	1,875,774	1,949,722	2,128,871
Total	**2,213,373**	**2,411,796**	**2,556,455**	**2,964,783**

Source: Gartner (April 2013)

Mobile Internet users will surpass PC internet users in 2015

The number of people accessing the Internet from smartphones, tablets and other mobile devices will surpass the number of users connecting from a home or office computer in 2015, according to a September 2013 study by market analyst firm IDC.

PC is the new Legacy!

Five mobile trends with significant implications for the enterprise

Mobile enables the Internet of Things
Global Machine-to-machine connections will increase from 2 billion in 2011 to **18 billion** at the end of 2022

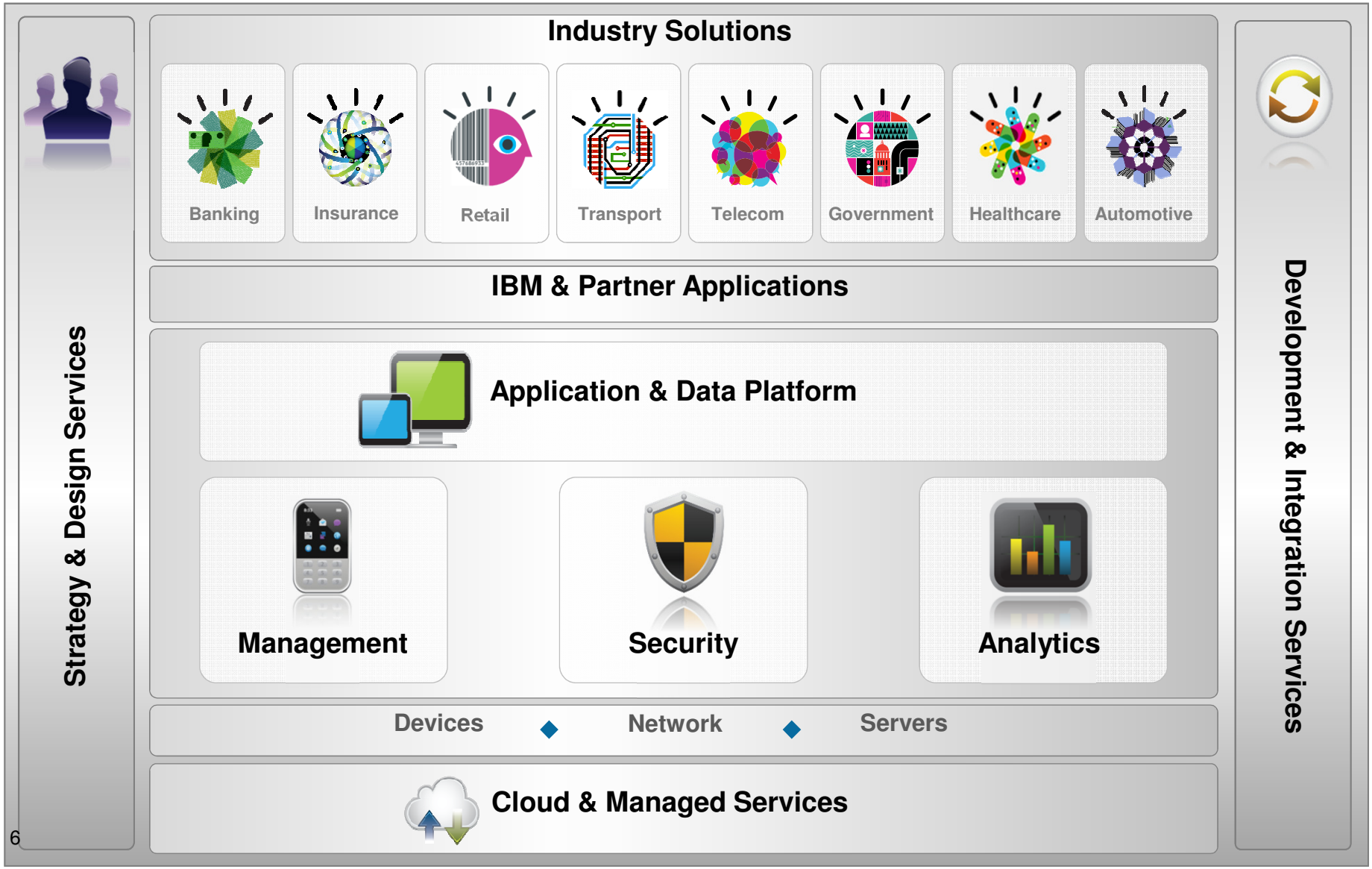
Mobile is primary
91% of mobile users keep their device within arm's reach 100% of the time

Mobile must create a continuous brand experience
90% of users use multiple screens as channels come together to create integrated experiences

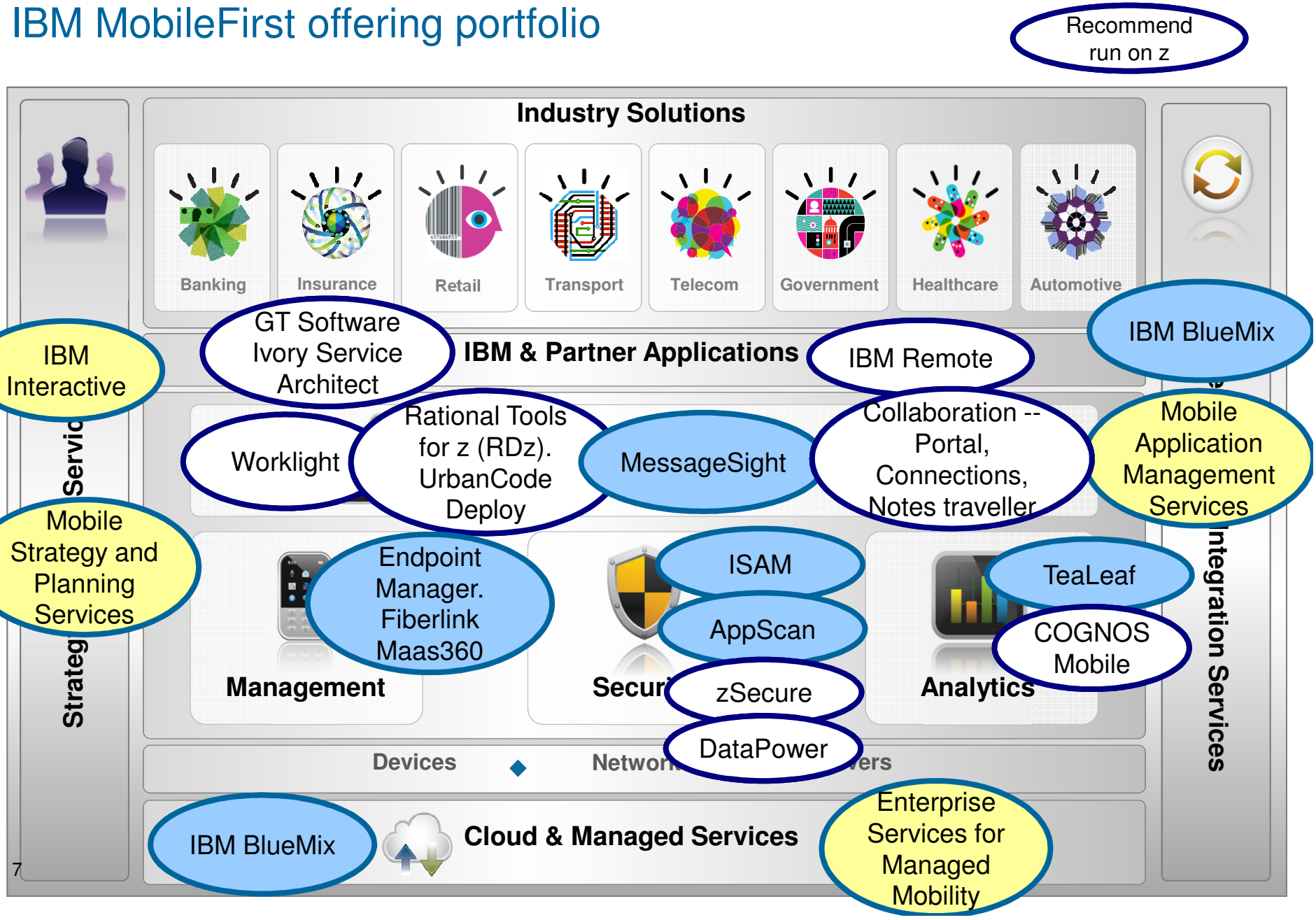
Insights from mobile data provide new opportunities
75% of mobile shoppers take action after receiving a location based messages

Mobile is about transacting
96% year to year increase in mobile cyber Monday sales between 2012 and 2011

IBM MobileFirst offering portfolio



IBM MobileFirst offering portfolio



Enterprises face unique mobile application challenges

Fragmentation and developing for multiple mobile platforms

- Highly fragmented set of devices, platforms, languages, and tools complicates development, test, and operations

Accelerated time to market requirements

- Accelerated development demands instant provisioning of development servers.
- Spikey mobile traffic demands highly scalable cloud-based infrastructures, for both SoE and SoR.

Connecting apps with existing enterprise systems

- Apps typically need to leverage existing enterprise services, which must be made mobile-consumable, and remain secure.
- Enterprise systems must be able to instantly provision new services and environments.

…and Unique z Requirements

- Development tools that seamlessly integrate z data and trans.

- Mobile tools supported in Cloud-based development and production environments.

- Easy access to z data and trans.
- End to end trans security.
- Low incremental MIPS cost.

IBM continues to redefine and extend the role of the mainframe to deliver new strategic capabilities and deeper client value

Data Ready

Enterprise data repository that integrates operational analytics for accelerated insight

- **Enterprise data hub**
- **High-volume secure and reliable transaction processing**
- **Integrated, real-time operational analytics**

Mobile Ready

Connecting backend systems to mobile devices to turn each interaction into an opportunity

- **Build and connect to back end systems**
- **Secure and manage with the highest level of security**
- **Extend and transform capabilities to mobile devices**

Cloud Ready

Highly scalable, agile heterogeneous enterprise private cloud

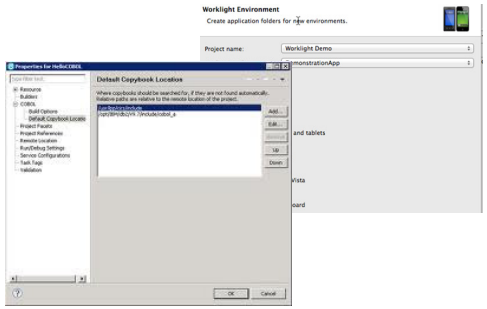
- **Elastic, virtually limitless expansion**
- **Shared everything design**
- **Secure hybrid computing with centralized management**
- **Built on open industry standards**

Security Ready

Trusted security and reliability for critical business processes, applications and data

- **Ultimate data security protection**
- **Built-in cryptography**
- **Unmatched resiliency and availability**

Mobile on z Systems



z Systems applications

Core CICS, IMS, DB2 and other applications and databases cloud and mobile ready

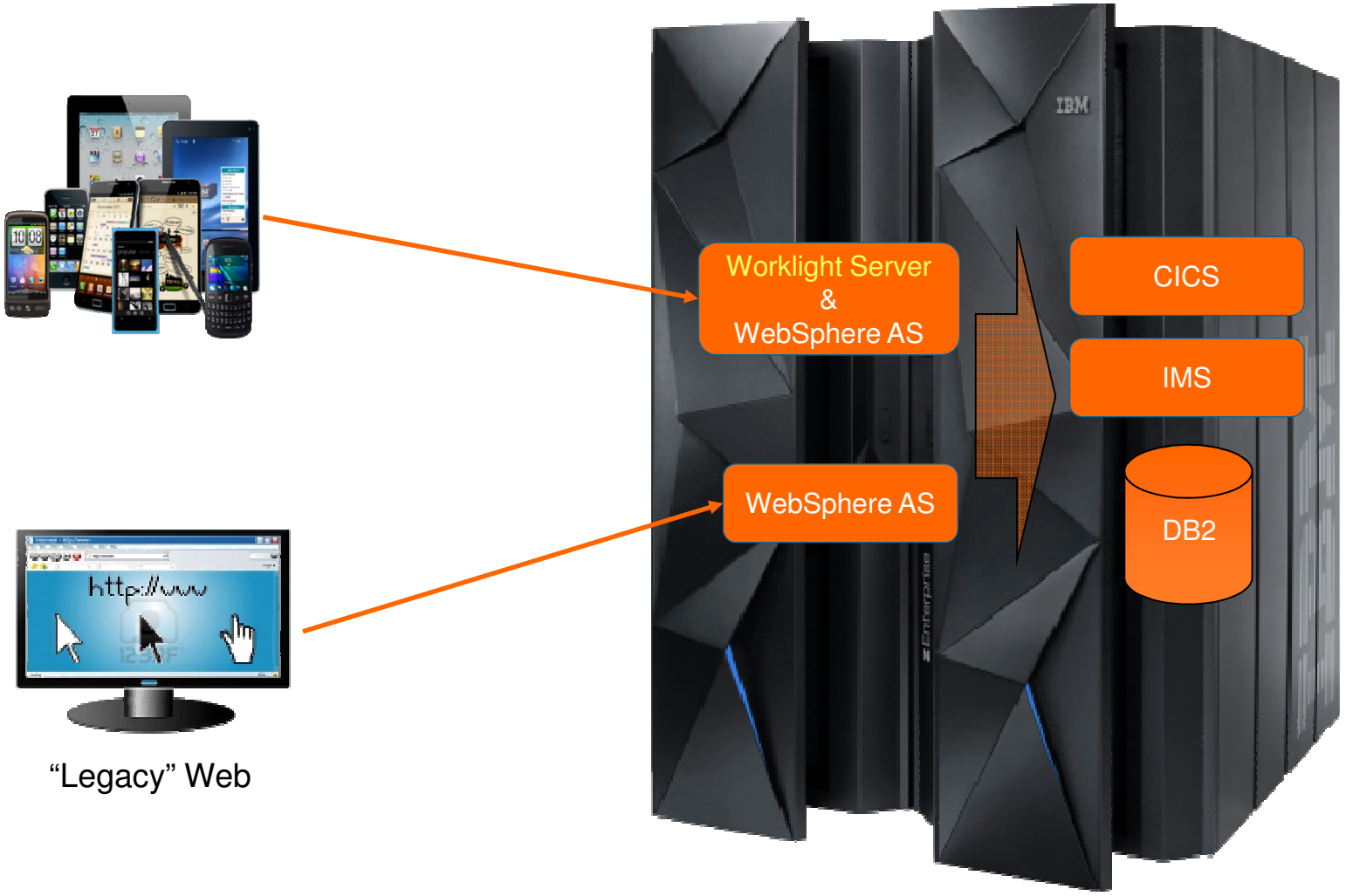
Mobile Apps

developed using Worklight for flexible, secure, low-latency access to z/OS data

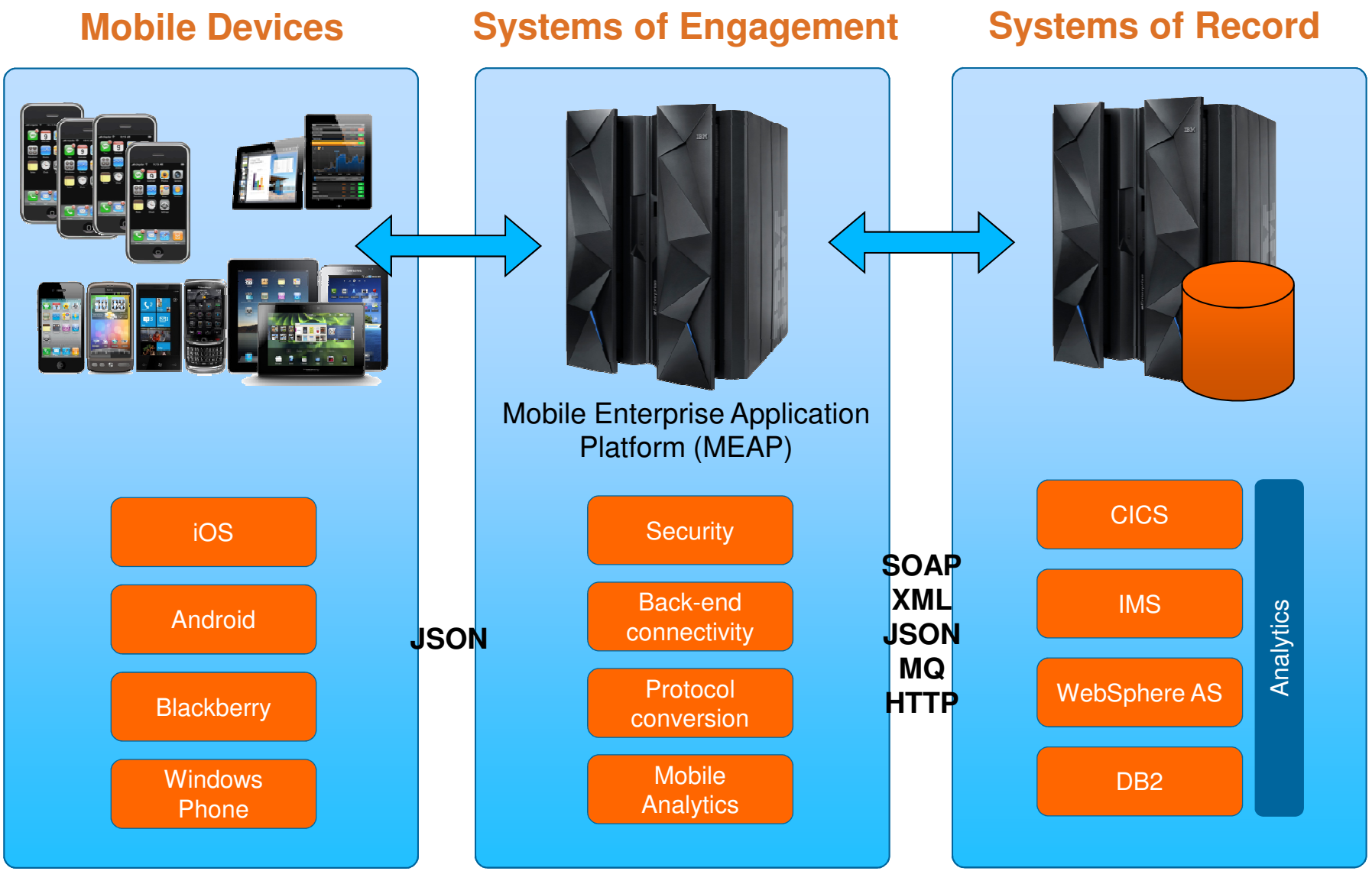
Infrastructure

Massive scalability in a single footprint for both z/OS and Linux environments. Secure your customers private data. Cloud orchestration, provisioning and automation with Tivoli® solutions

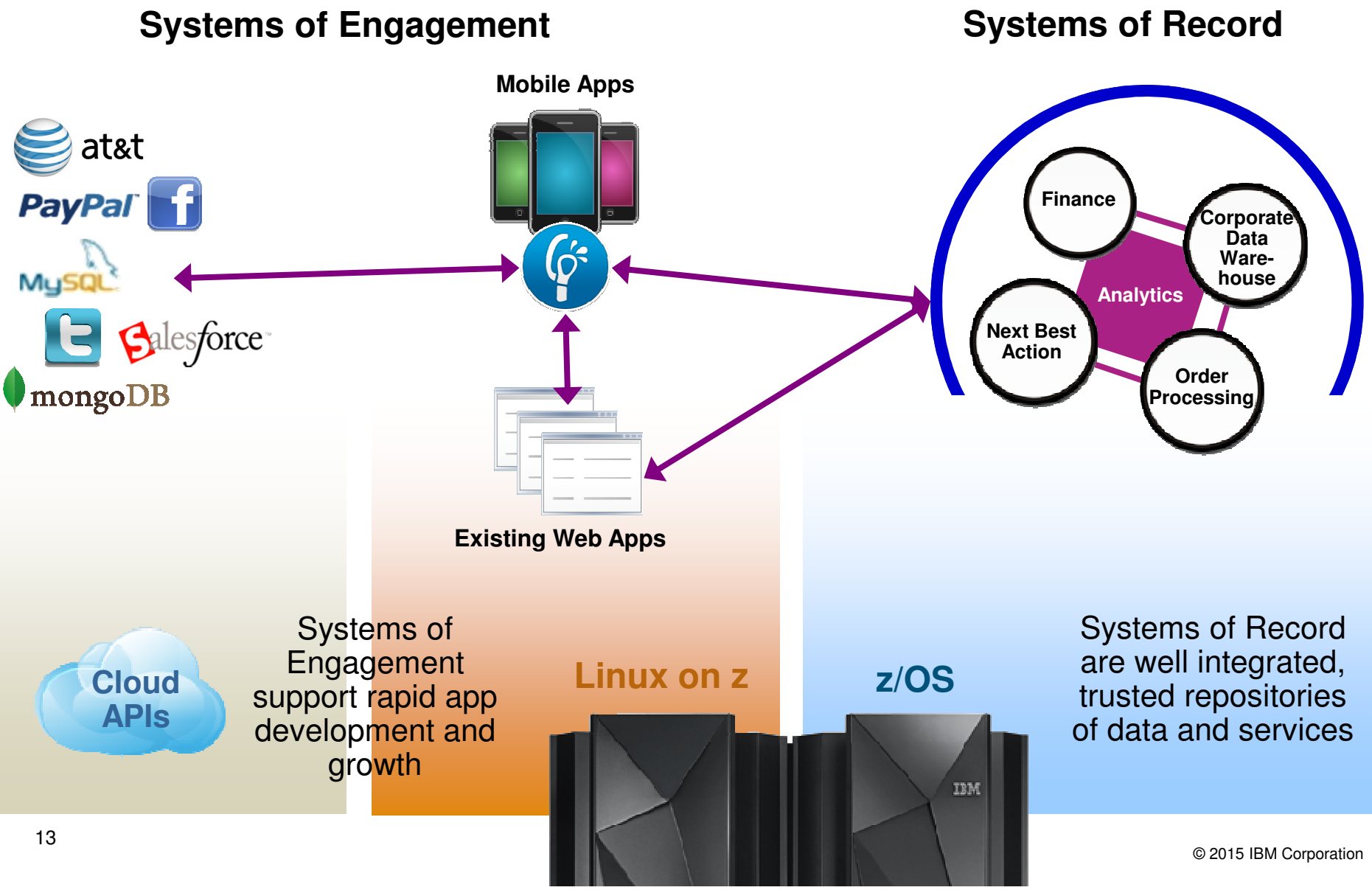
Mobile is a new channel into the Enterprise



Tiered mobile environment



z Systems bridge Systems of Record and Systems of Engagement



z Systems provide essential services for mobile applications

As Systems of Record (z/OS)

1. We provide easily consumable mobile access to all the data and transaction in z subsystems (DB2, CICS, IMS, MQ, etc)
   - Customer can create engaging mobile apps *today* using existing z transactions.
2. z/OS availability and scalability is crucial for mobile workloads.

As Systems of Engagement (Linux on z)

1. We have the tools to satisfy the lifecycle requirements for mobile application development – Worklight studio and server, Rational, UrbanCode.
2. Linux on z Systems is a good fit for mobile infrastructure
   - Availability and scalability to handle mobile workloads.
   - Exploit z security and encryption for use by mobile apps.
   - Exploit co-location with z/OS data and transactions (hipersockets, no SSL required)
   - Leverage our cloud capability to create new mobile dev and production clouds

The IBM mobile application development lifecycle

Design & Develop
Worklight and
Rational Developer

Instrument
Tealeaf (User Experience)
Security (Fiberlink, Trusteer)

Obtain Insight
Tealeaf

Integrate
Worklight, Cast Iron

Manage
Fiberlink

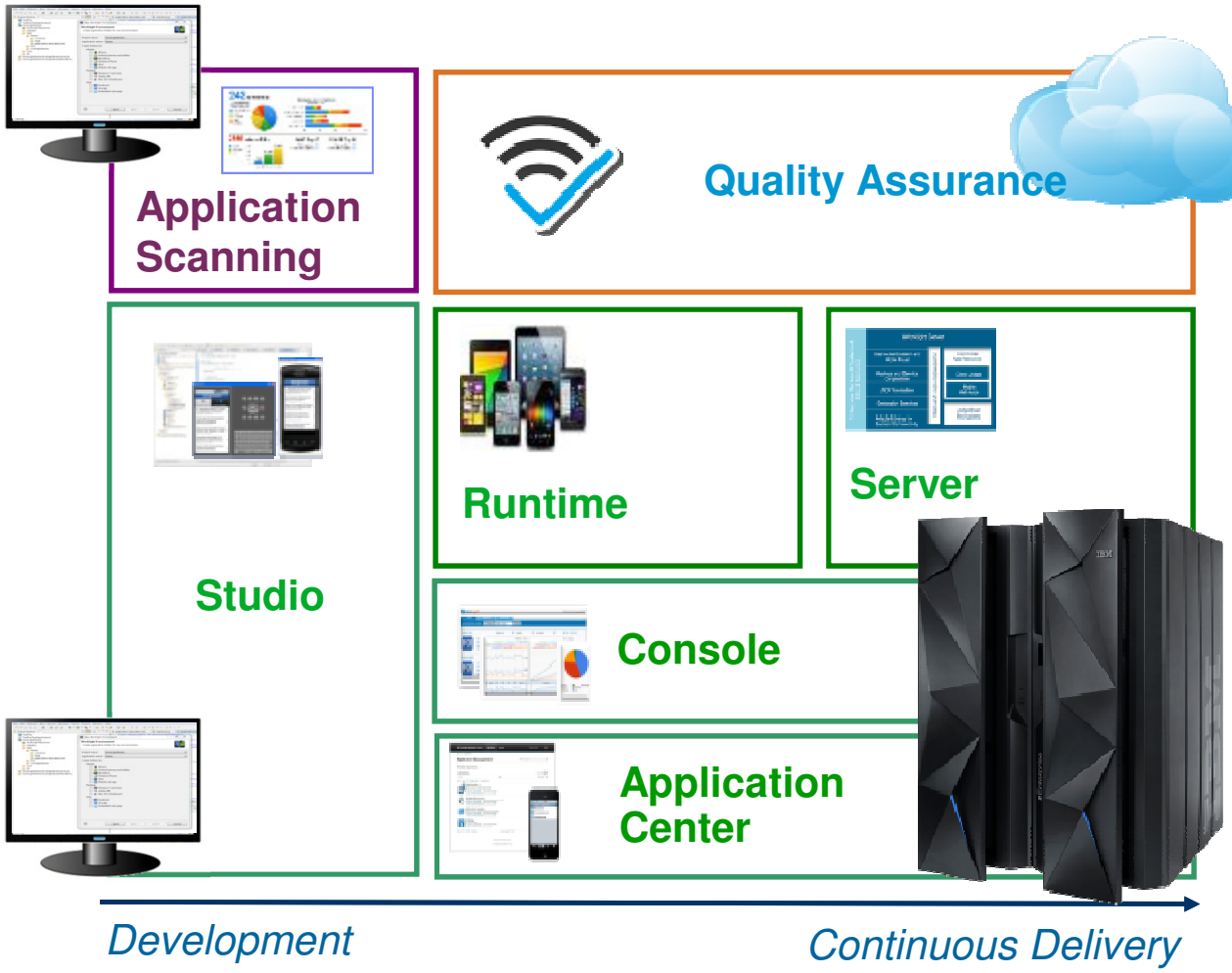
Test
Rational Test Workbench
Mobile Quality Assurance

Deploy
Worklight, UrbanCode

Scan & Certify
AppScan

The IBM Worklight Platform

Integrated mobile app development with continuous delivery

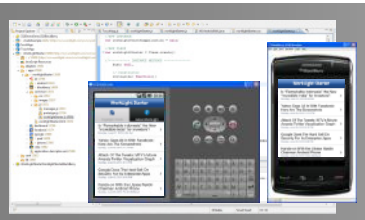


Application Scanning
Detect code vulnerabilities at the time of development

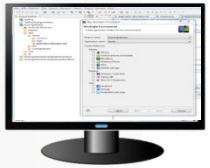
Quality Assurance
Collect beta test feedback, crashes and analyze user sentiment

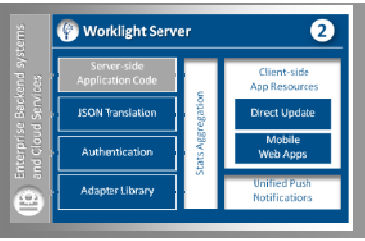
Foundation
Development, Runtime, Operations Console & Private Store

IBM Worklight overview

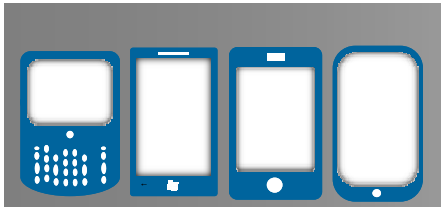


Worklight Studio
The most complete, extensible environment with maximum code reuse and per-device optimization

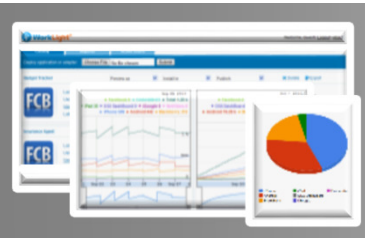




Worklight Server
Unified notifications, runtime skins, version management, security, integration and delivery



Worklight Device Runtime Components
Extensive libraries and client APIs that expose and interface with native device functionality

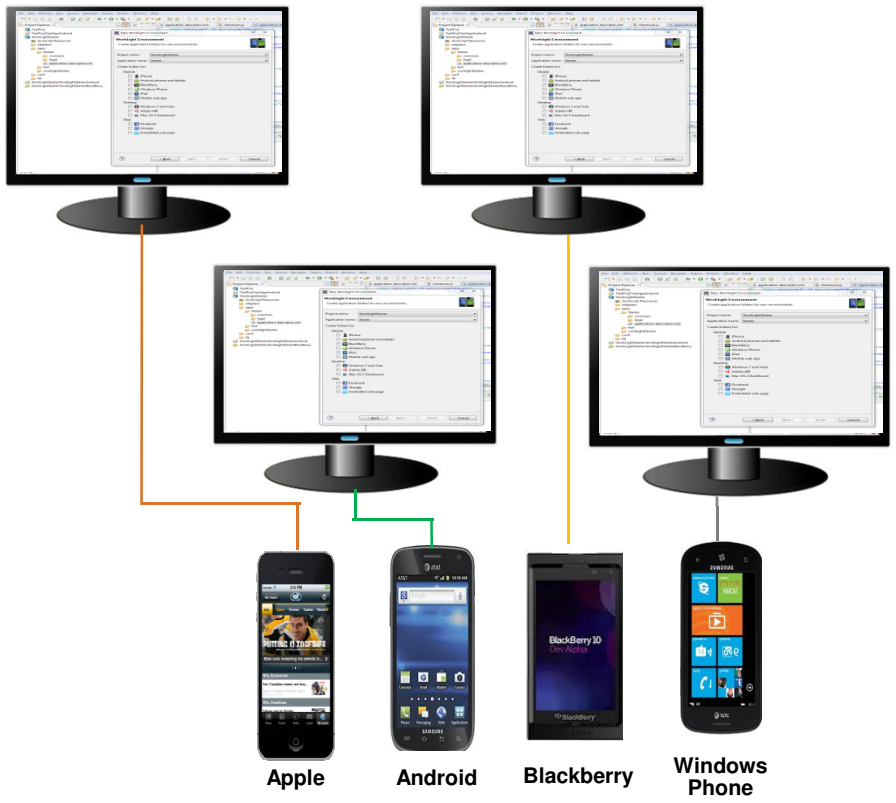


Worklight Console
A web-based console for real-time analytics and control of your mobile apps and infrastructure

Rapid multi-platform development using a single shared codebase

From the complexity of many…

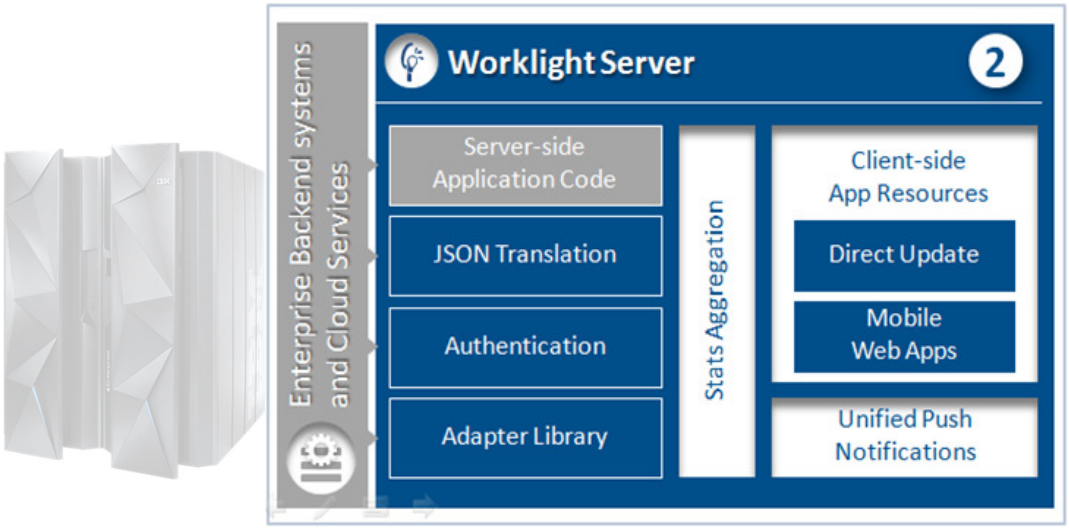
- Multiple sets of tools & frameworks
- Four codebases to develop and maintain



To the simplicity of one

- One development environment
- One codebase to develop and maintain

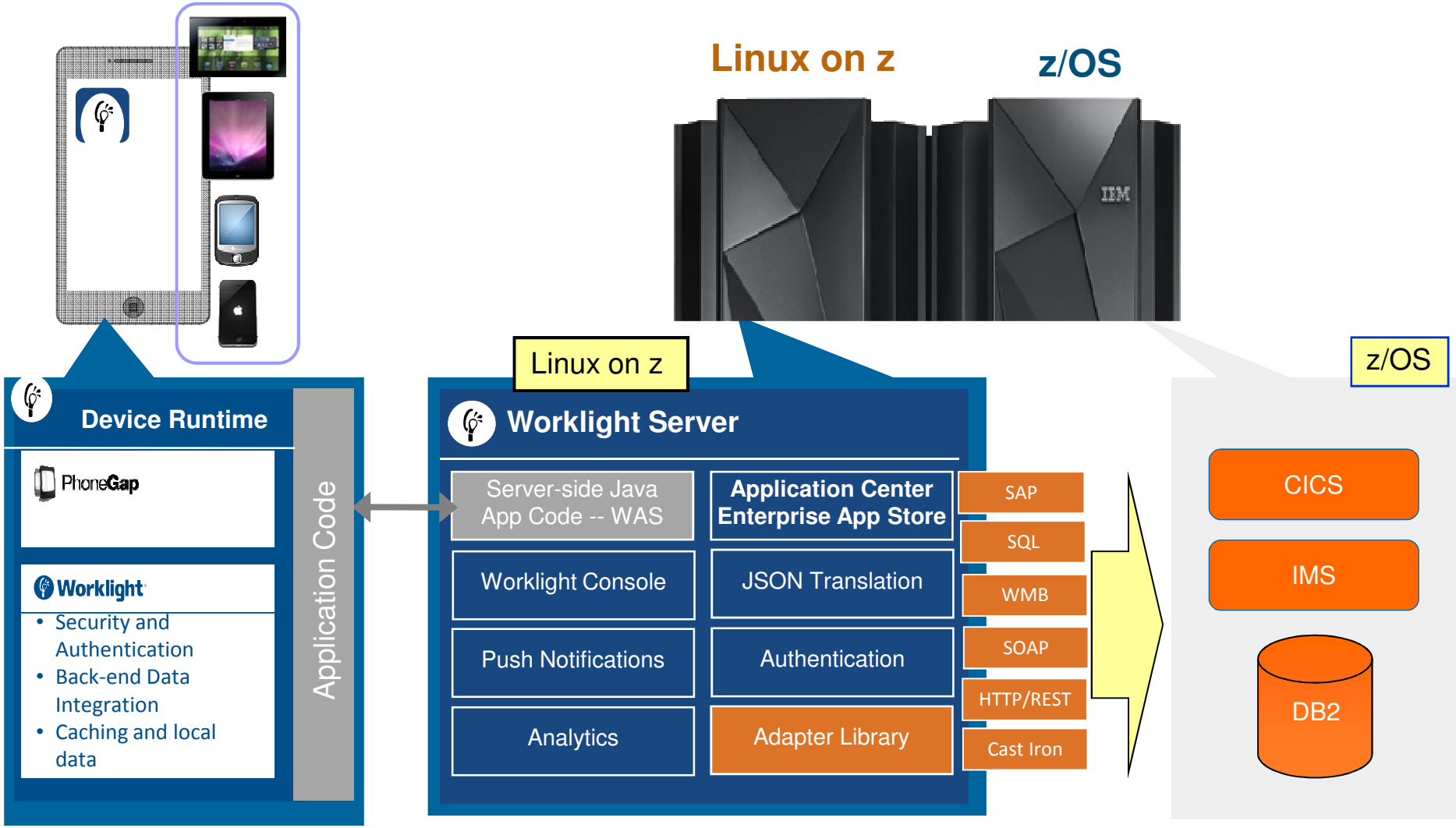
Worklight Server



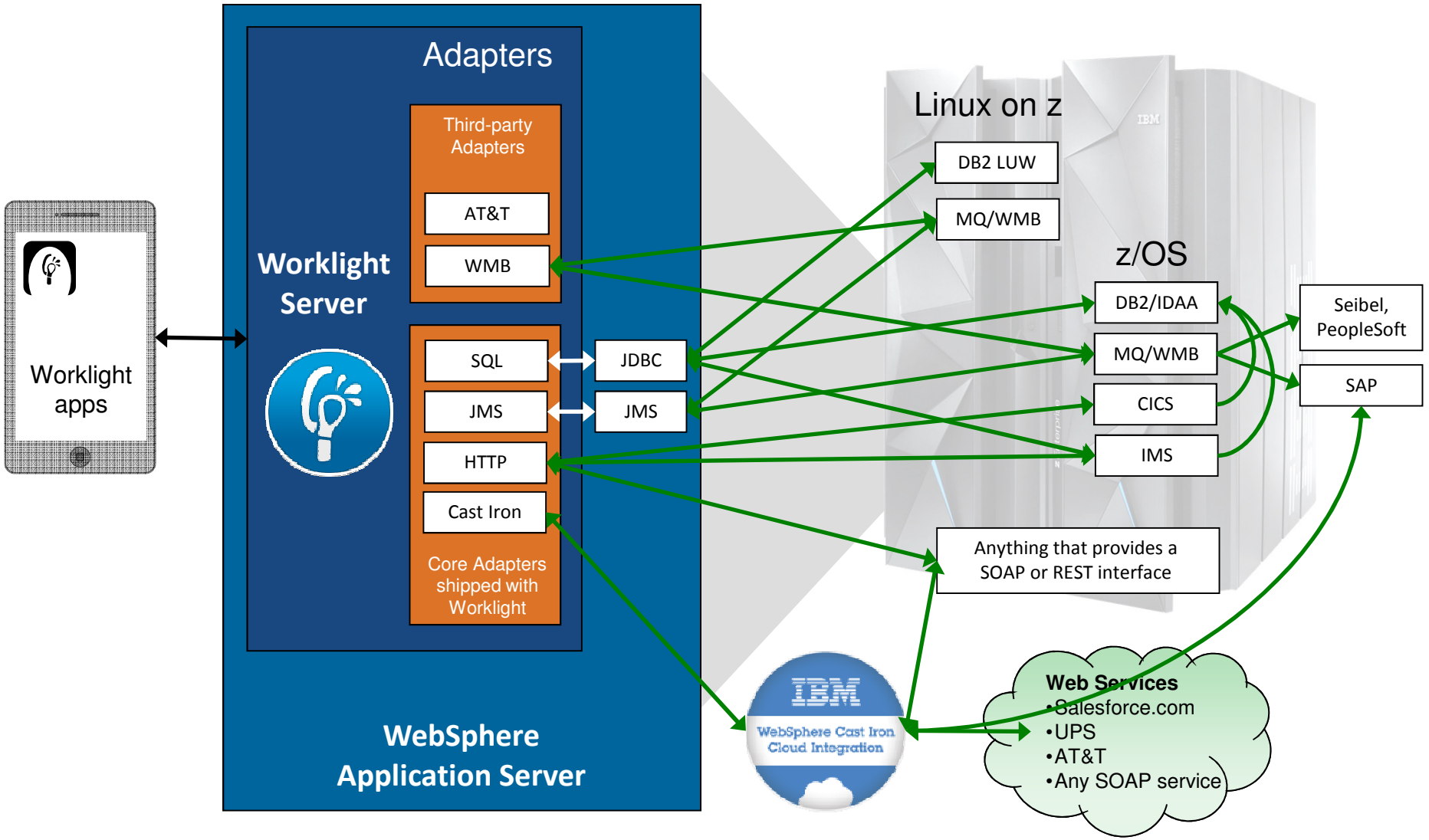
Worklight Server is a **WebSphere Application Server (WAS)/Java application**, supported on **z Systems Linux** – WAS 7, 8, 8.5 on SLES 10, 11, and RHEL 5, 6. It provides:

- **Adapters** are used to communicate to back-end services like databases, transaction systems, MQ, etc.
- **Data Transformation** - JSON is used to communicate to mobile devices – translation is done to HTTP or Web Services that are used by server components.
- Server and device **Security** control
- Controls Application Deployment and **Versioning**
- **Push Notification** administration
- **Analytics** including user adoption and usage data
- An **Enterprise App Store** for your B2E applications.

IBM Worklight Server on z Systems



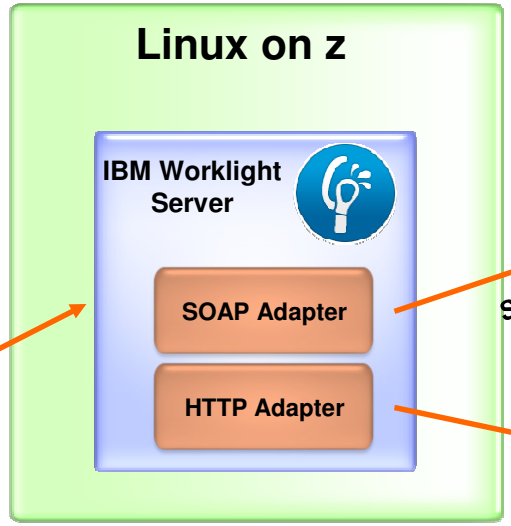
Mobile Apps can connect to z Systems today -- via Worklight



Worklight adds a Mobile UI to CICS Services

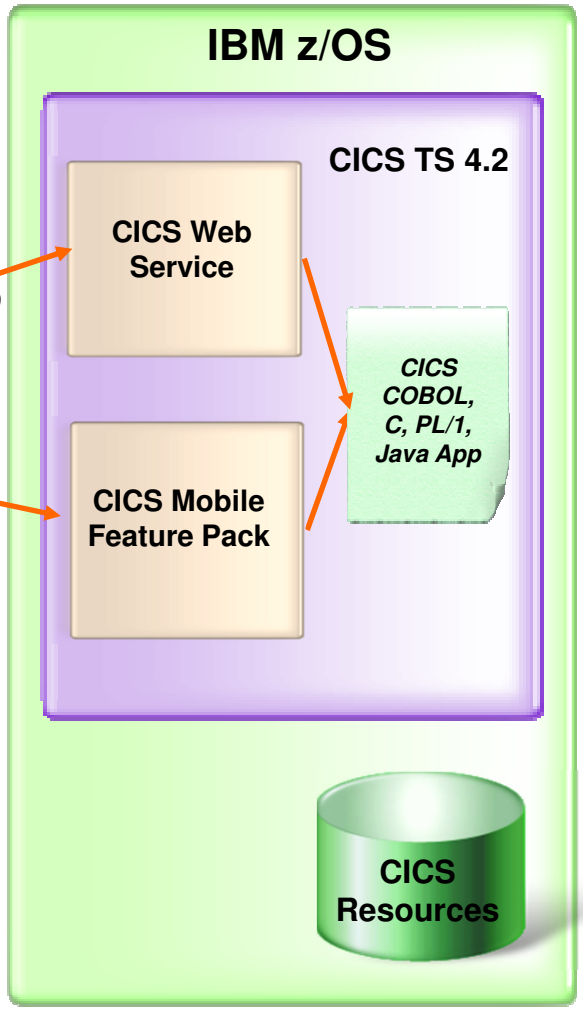
CICS Mobile Feature pack provides direct JSON connection to CICS.

Mobile Devices



SOAP (XML)

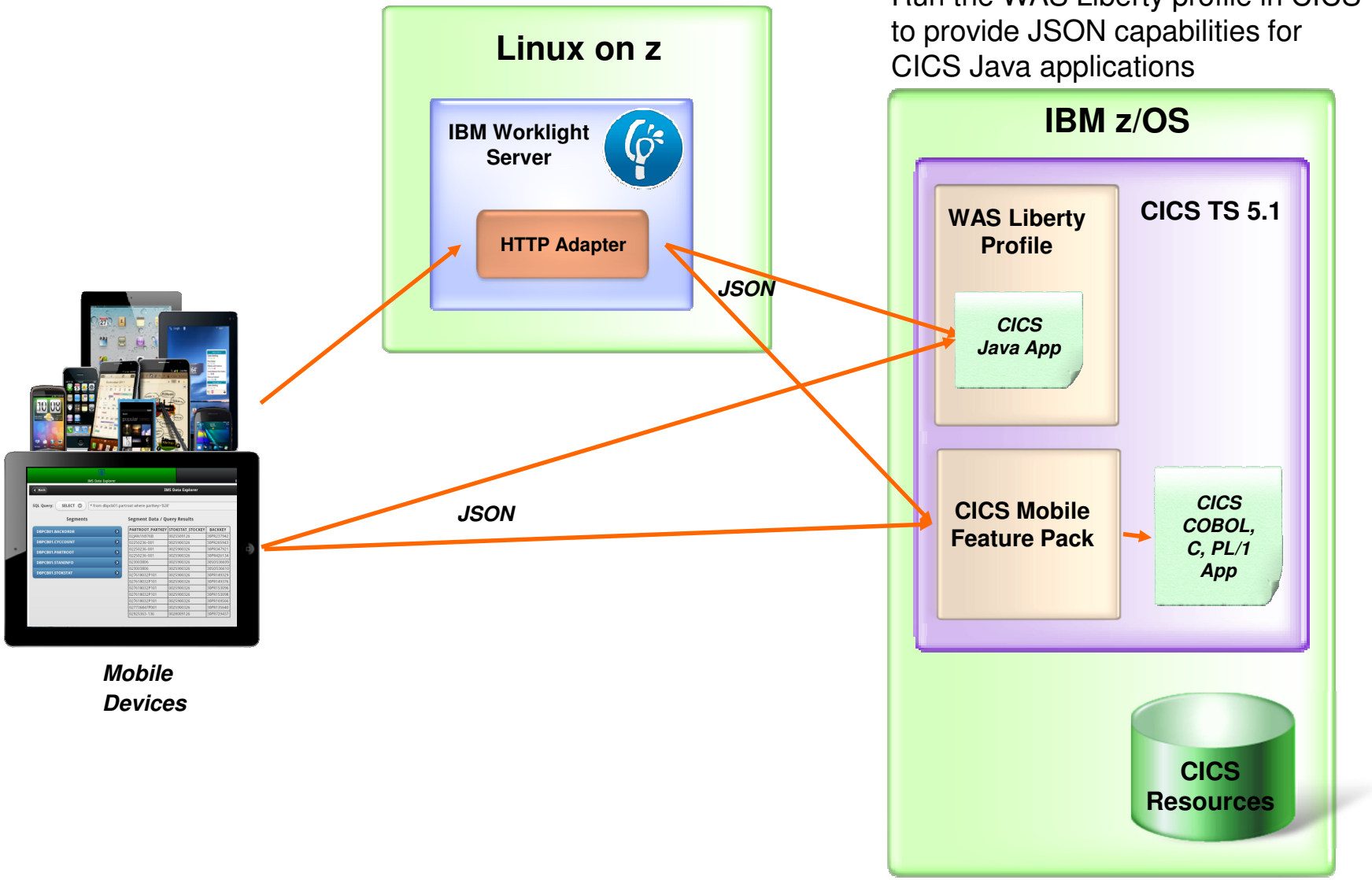
JSON



IBM CICS TS feature pack for Mobile Extensions (CICS TS 4.2+)
Further simplifies Worklight-CICS connectivity with JSON support in CICS.

CICS Mobile Enablement (CICS TS 5.1)

Run the WAS Liberty profile in CICS to provide JSON capabilities for CICS Java applications

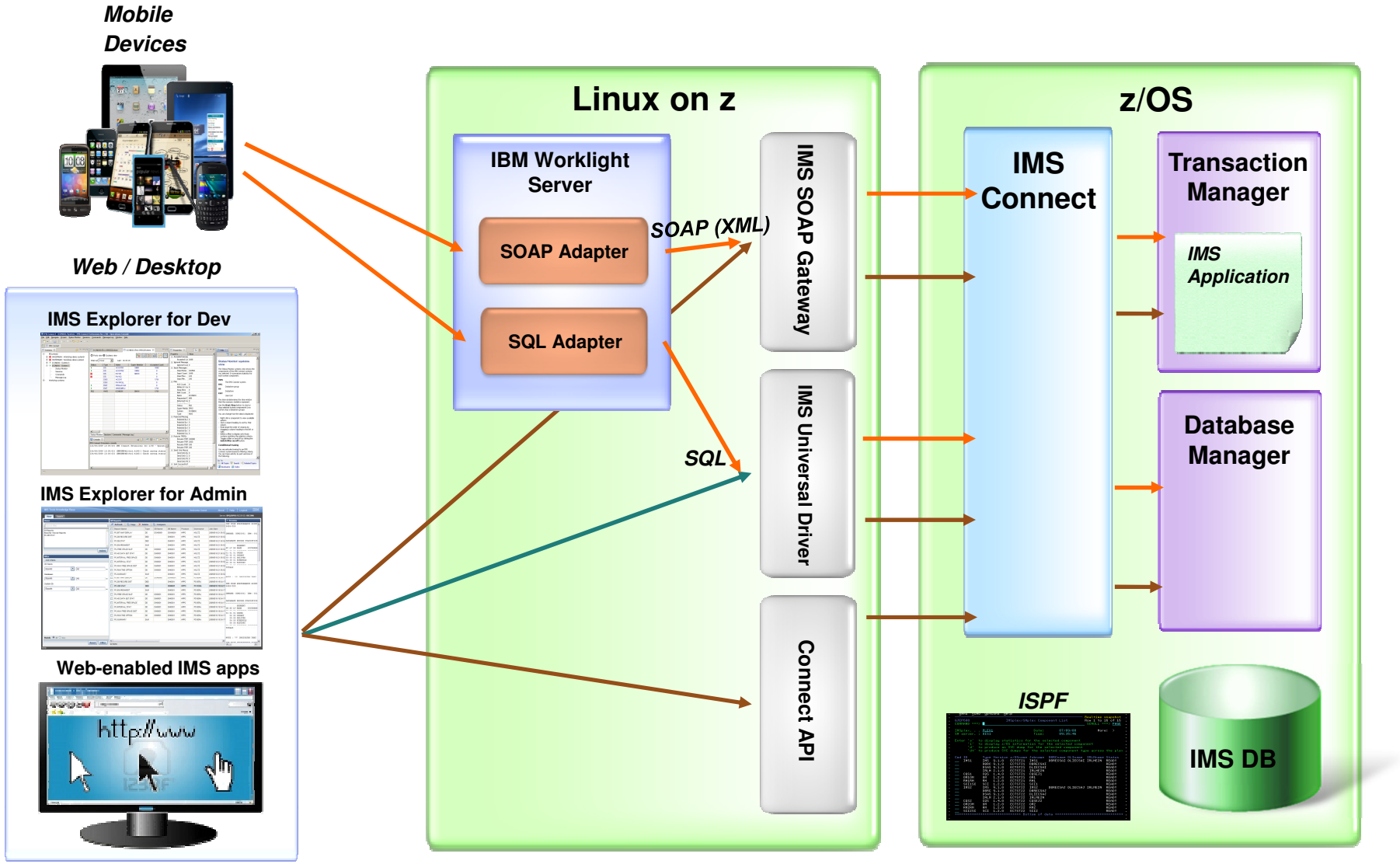


CICS Mobile Demo

- Worklight on Linux for z Systems
- Talking to CICS
- CICS Sending push notifications to mobile devices.
- All this done without changing any code in the CICS transactions.

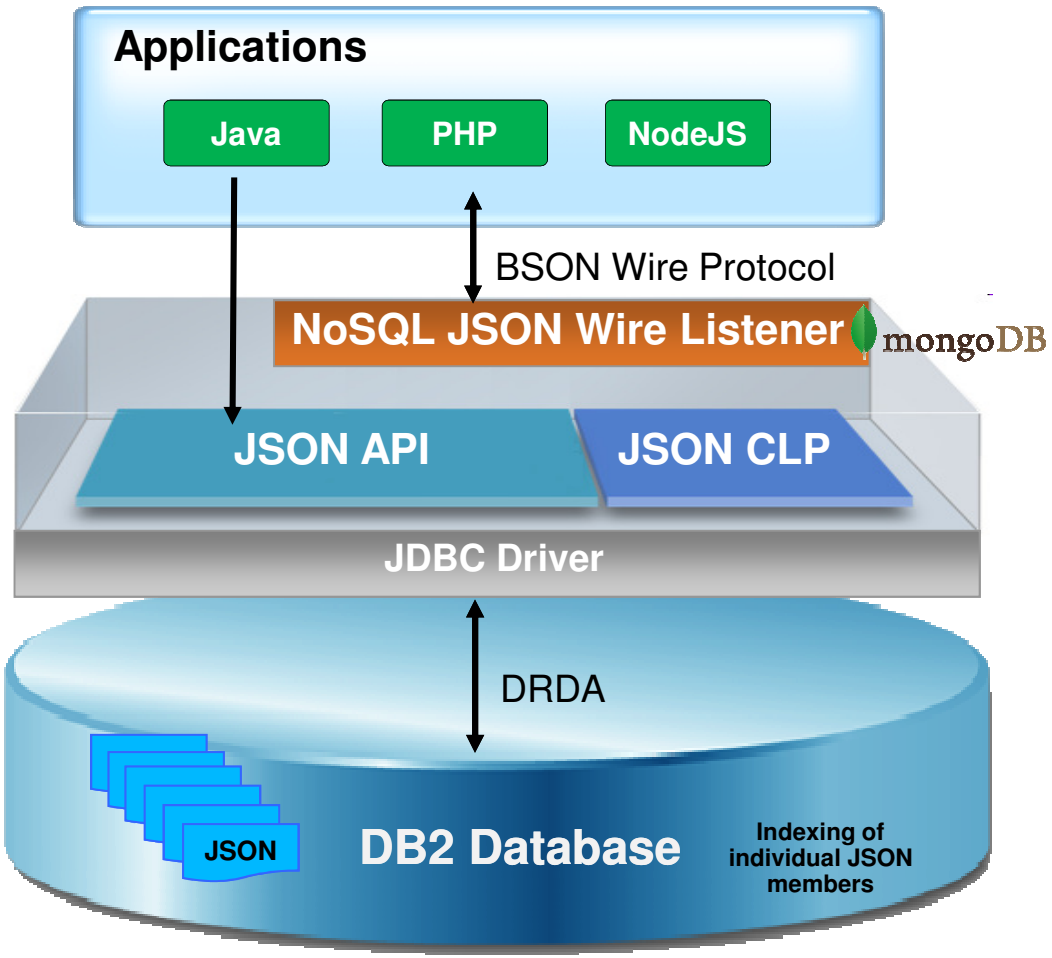
http://youtu.be/6TkQ9PzeevQ

IMS Mobile Enablement



DB2 NoSQL (MongoDB) JSON Support

- **The best of both worlds – NoSQL agility and flexibility built on the trusted foundation of DB2**
  - Write applications using Mongo APIs to access data on DB2.
  - Flexible schemas allow rapid delivery of applications
- Preserve traditional DBMS Capabilities, leverage existing skills and tools:
  - Multi-statement Transactions
  - Management/Operations
  - Security
  - Scale, performance and high availability
- Extend with Advanced features (future)
  - Temporal semantics
  - Full Text search
  - Multi-collection joins
  - Combine with Enterprise RDBMS data
- Implementation leverages open source community drivers.
- **Available in DB2 for z/OS V10 now.**
  In DB2 for z/OS V11 expected June 2014.

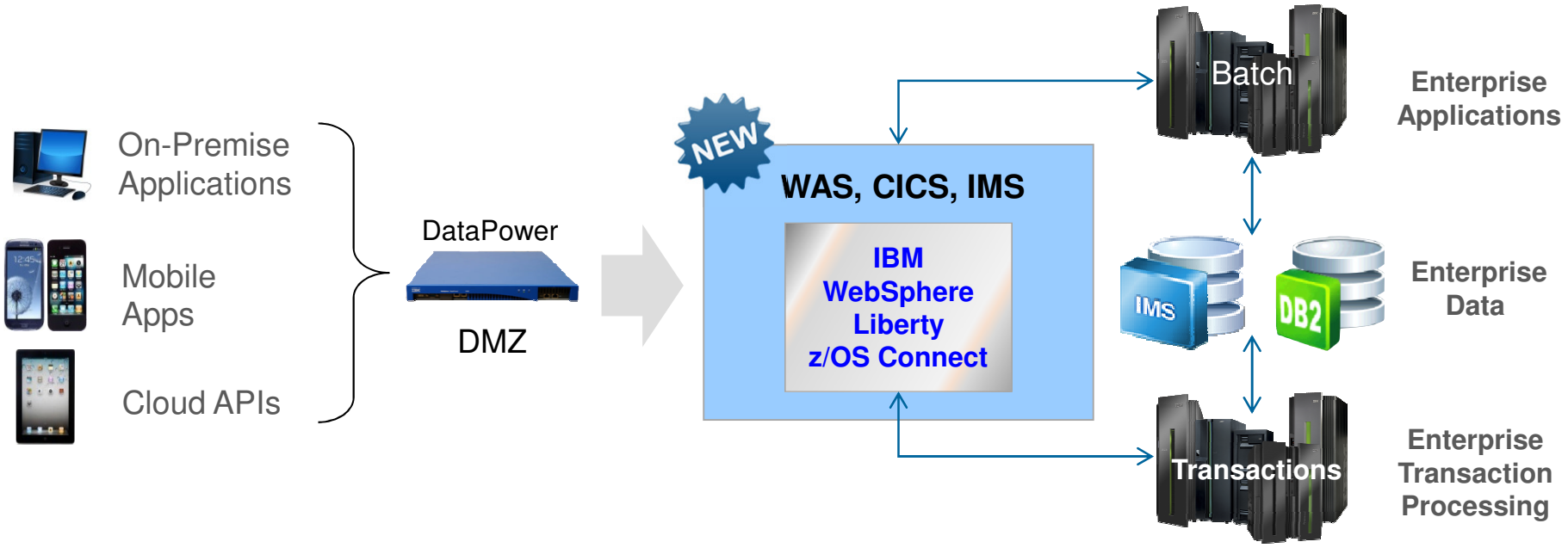


IBM WebSphere Liberty z/OS Connect

Secure and Consistent Enterprise Connectivity for Mobile

Ships with WAS, CICS, and IMS

- **Designed for z/OS** – builds on z/OS qualities of service. Auditing, chargeback.
- **Unifies connectors** – a common solution for mobile, cloud, and web
- **Simplified integration** – Hide complexity of connecting to z/OS using REST
- **Discover z/OS assets** – Enhance user experience by exposing z/OS data



The Mobile Security ecosystem

At the Device

Manage device
Set appropriate security policies • Register • Compliance • Wipe • Lock

Secure Data
Data separation • Leakage • Encryption

Application Security
Offline authentication • Application level controls

Mobile App

Secure Application
Utilize secure coding practices • Identify application vulnerabilities • Update applications

Integrate Securely
Secure connectivity to enterprise applications and services

Manage Applications
Manage applications and enterprise app store

Over the Network

Secure Access
Properly identify mobile users and devices • Allow or deny access • Connectivity

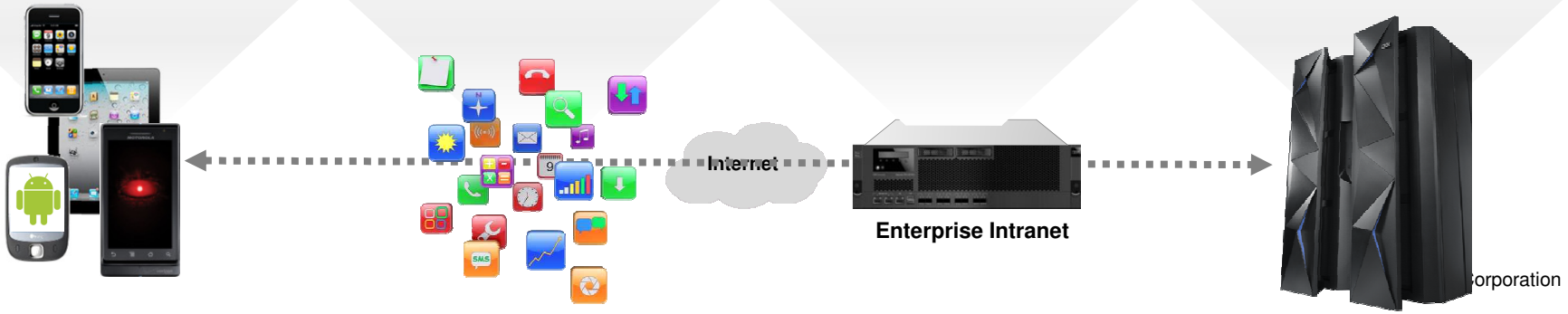
Monitor & Protect
Identify and stop mobile threats • Log network access, events, and anomalies

Secure Connectivity
Secure Connectivity from devices

Within the Enterprise

Transaction Security
Properly authenticate mobile users

Secure Connectivity
Secure Connectivity from devices



The Mobile Security ecosystem

Recommend running on z

At the Device

Endpoint Manager for Mobile

• Wipe • Lock

Trusteer

Application Security

Offline authentication

WorkLight Runtime

Mobile App

Secure Application

Utilize secure coding

AppScan for Mobile

Integrate Securely

WorkLight Server

Manage applications and enterprise app store

Over the Network

Secure Access

Access Manager for Mobile

Monitor & Protect

QRadar

anomalies

DataPower XI50z

from devices

Within the Enterprise

zosConnect

Secure Connectivity

RACF, PKI, Hardware crypto

zSecure

Enterprise Intranet

z Systems address Enterprise mobile development and delivery challenges

Fragmentation and developing for multiple mobile platforms

- Highly fragmented set of devices, platforms, languages, and tools complicates development, test, and operations

Accelerated time to market requirements

- Accelerated development demands instant provisioning of development servers.
- Spikey mobile traffic demands highly scalable cloud-based infrastructures, for both SoE and SoR.

Connecting apps with existing enterprise systems

- Apps typically need to leverage existing enterprise services, which must be made mobile-consumable, and remain secure.
- Enterprise systems must be able to instantly provision new services and environments.

IBM Worklight Studio and RDz

- Seamless integration with z data and transactions
- Device runtime provides mobile device independence

z Systems Scalability

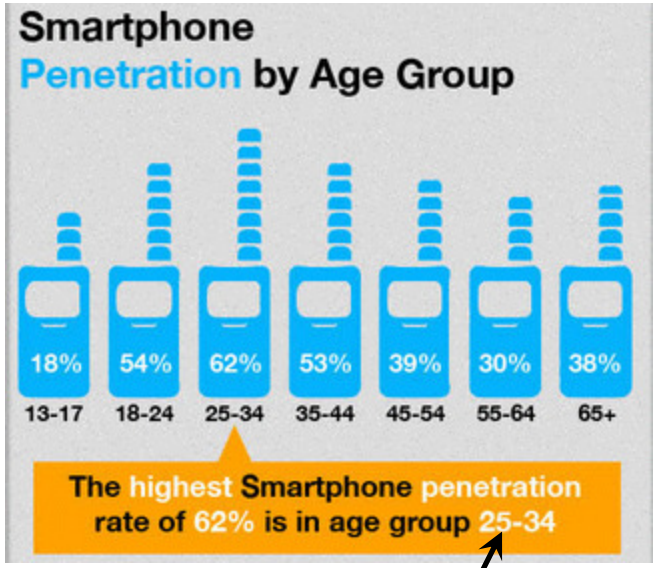
- z Systems Linux cloud enables rapid provisioning of Worklight servers
- z/OS is the leader in transaction processing and easily scalable to handle workload increases

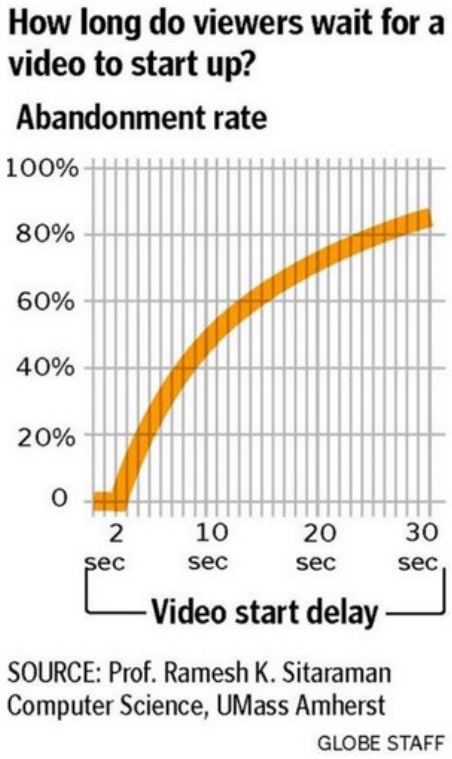
z/OS is mobile enabled

- z/OS subsystems are mobile-ready
- End to end mobile security
- High-performance access from Linux on z

Why Mobile on z Systems?

Smartphone users demand instant gratification and real data





#1 reason people in the UK switch banks is dissatisfaction with their old bank's app

Millenials are the battleground for new customers –
they have no patience –
they expect the data to be instant and up-to-date

Banks are feeling competitive pressure and need strong solutions

"… if we don't offer the functionality desired by our customers

… there is a significant risk of falling behind in the market where competitors are already offering these services

… we will fail to attract sufficient custom to achieve the target to grow market share

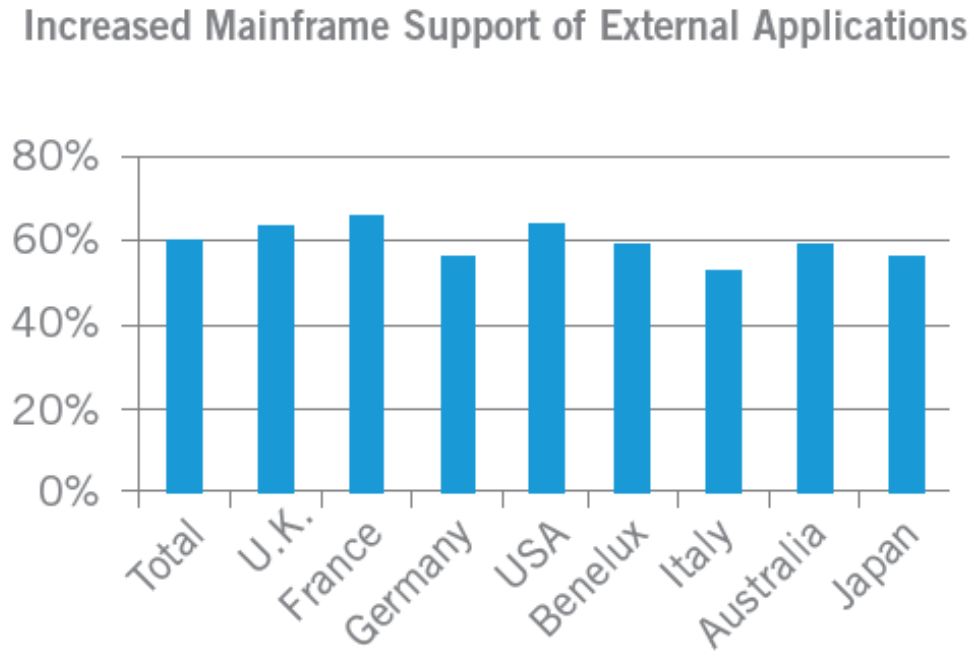
… Smartphone channels offer a true alternative in many instances to the internet self-service channels…"

The quickest and most cost-effective way to open a mobile channel is to modernize existing assets

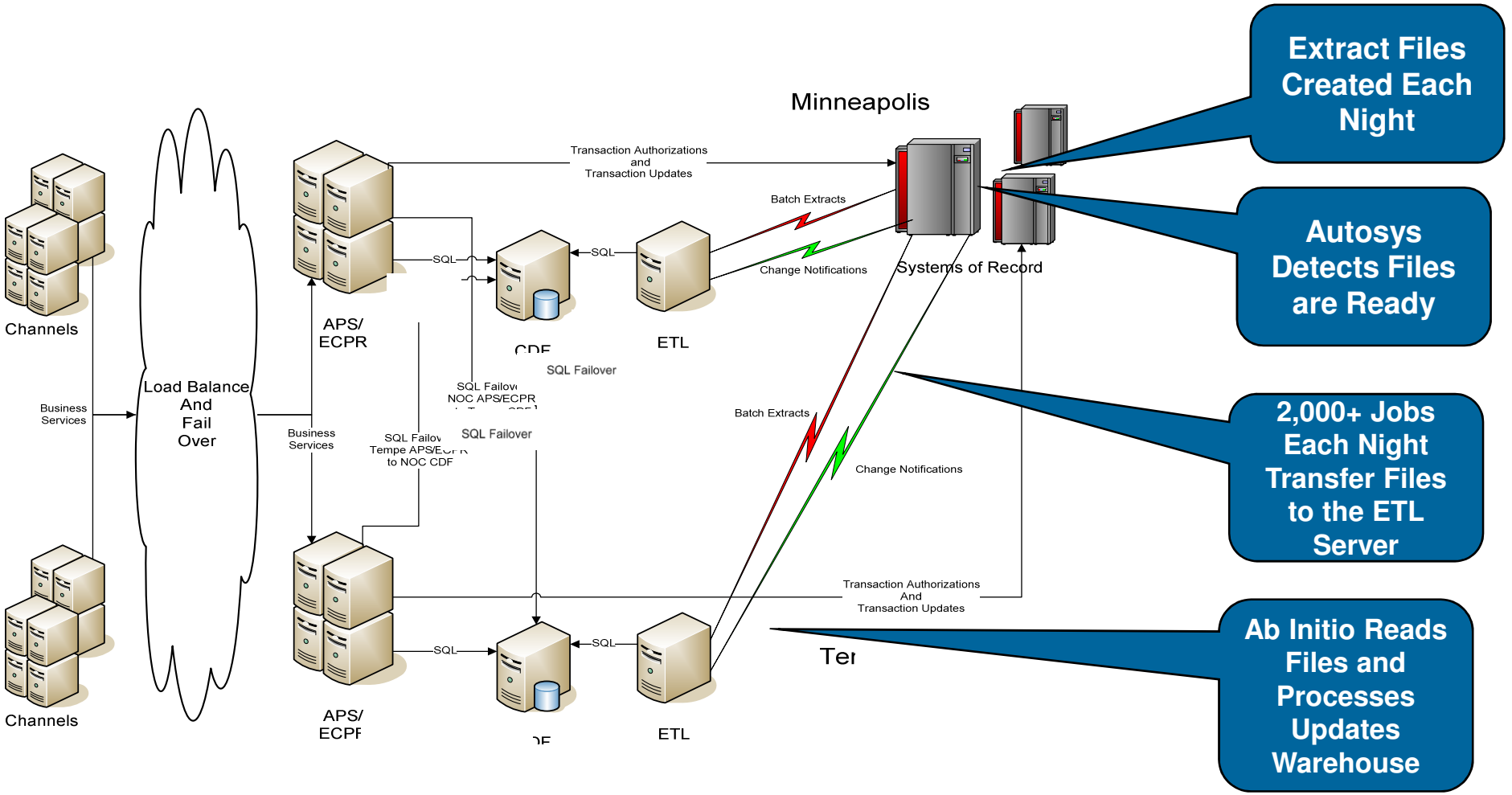
- In September 2012, the independent research firm Vanson Bourne studied the impact of new IT trends and models
  - Interviewed 520 CIOs from large enterprises across a range of industries in the U.S., Europe & Asia

- 62% have enabled back-end functions to support e-commerce and mobile applications

- IBM Rational and Worklight tooling can help do this quickly and easily



A replicated copy is unacceptable – the data is always old – and results in excessive complexity and cost with negative ROI



Mobile-enabled businesses need an infrastructure that is *always-on, always-open*, and *always-protected*

z Systems delivers trust and confidence with unmatched security and reliability

Highest
assurance level of security with Common Criteria certification (EAL 5+)

Enterprise Key Management
across mainframe and distributed

Encryption
of data at rest, in flight, and in use

ENHANCED

IBM Security zSecure SSE

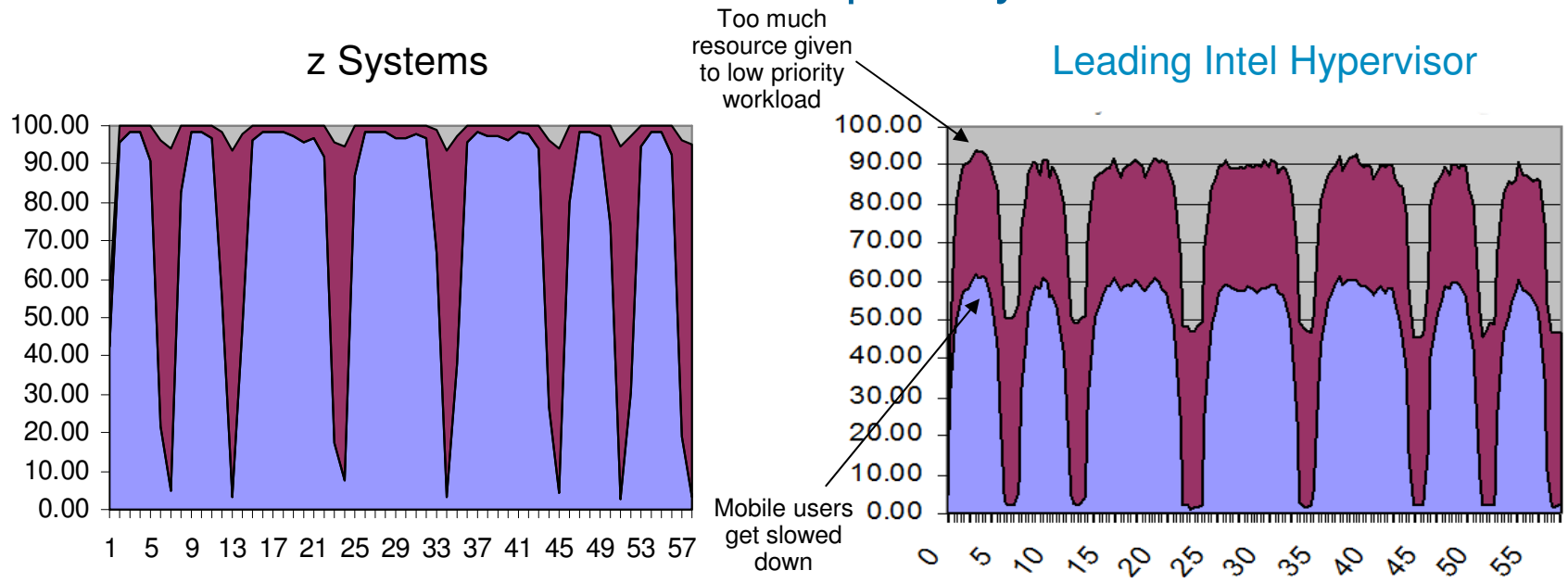
Prevent malicious attacks with enhanced security intelligence and compliance reporting, with up to **70% savings**

IT Analytics
to spot potential failures and capacity needs before they occur

99.999%
design point for application availability

Zero Second
recovery point objective across thousands of miles

z Systems workload management enables mixing mobile demand spikes with BAU workloads – without penalty

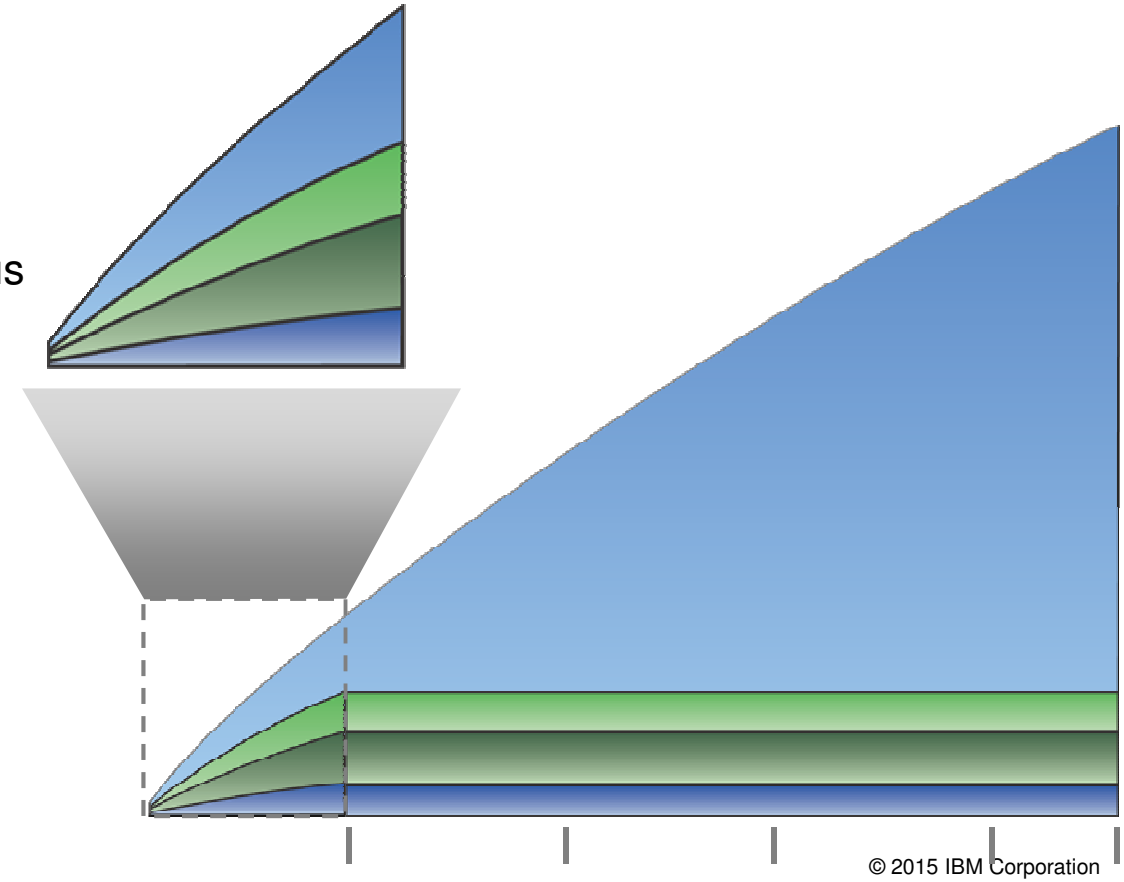


- Perfect workload management
- Consolidate workloads of different priorities on the same platform
- High utilization drives lower cost per unit of work

- Imperfect workload management
- Workloads must be segregated on different servers to achieve SLA
- Low utilization drives up cost

Mainframe servers can grow on-demand with a maximum capacity much higher than the largest requirement

- 50 to 111,000 MIPS in one box
- Very granular elastic growth
- Growth can be almost instantaneous
- Up to 32 boxes can be coupled together *sharing the same data* – unique differentiator



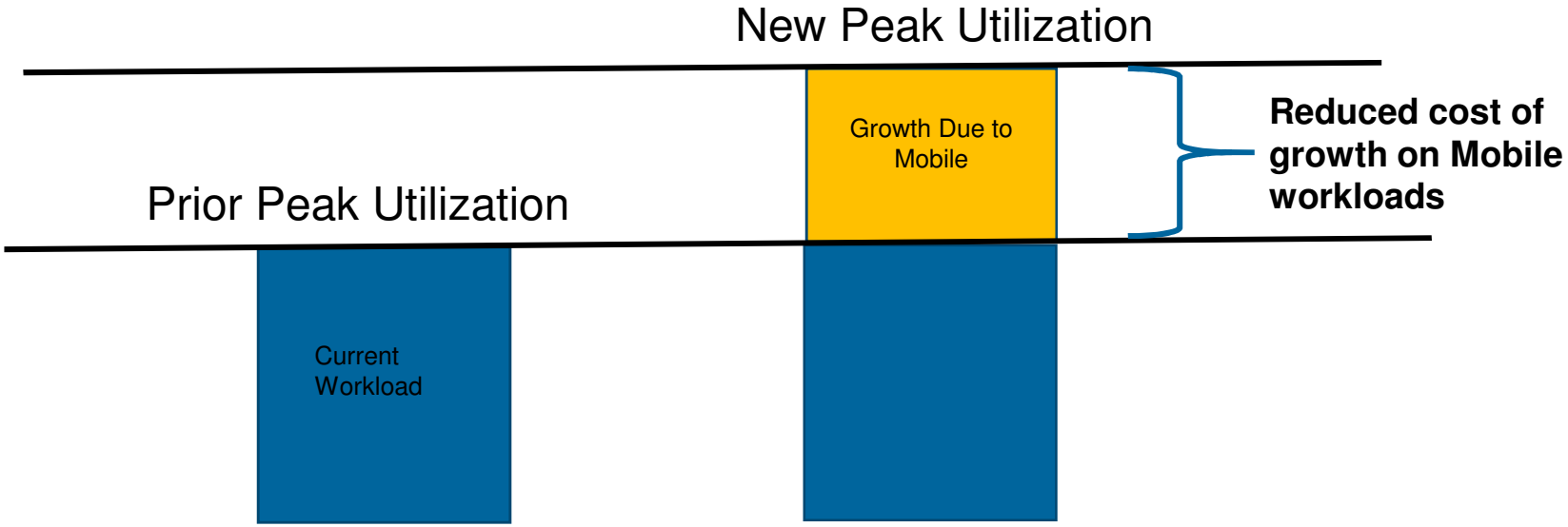
z Systems allows many new mobile workloads to co-locate with system of record data with maximum security and resiliency

- Strength and variety of IBM middleware
  - E.g. WorkLight for mobile, WebSphere eXtremeScale, DB2, Java…
- Fast in-memory communication 'pipes' to z/OS data and transactions
- New workloads can run on Linux on z Systems
- Appliances such as DataPower for security
- IDAA for high-speed high-intelligence analytics
- Single Point of Control
- Ease of backup and Disaster Recovery
- Extensive modern agile tooling and DevOps
- Advanced, mature, robust virtualization

All this extensibility is protected by mainframe RAS and security

New z Systems Mobile pricing enables IT investments to scale with the growth & business returns of mobile

- **Leverage** existing z Systems data and transaction processing for mobile
- **Scale** easily with new pricing option



- No Infrastructure Changes Required…
- Applicable to workloads running on zEC12 and zBC12.
- Up to a 60% reduction in reported CPU utilization for Mobile transactions

z Systems Unique Characteristics to support Mobile Applications

- Easy-to-consume APIs from CICS, DB2, IMS allow you to leverage your investment in z/OS transactions to quickly add a mobile channel.
- z/OS enables massive and simple scalability in a single footprint, to handle the workload of millions of devices and sensors
- Worklight security integrates with z/OS security providing end-to-end security and data privacy for mobile apps.
- z/OS Workload Management ensures your crucial applications remain responsive during sharp spikes in demand.
- Low-latency I/O. Mobile usage patterns favor short, read-only data requests (Users check account balances) So fast access to operational data, with low latency, is key. The mainframe offers exceptional I/O with dedicated hardware I/O processors. This reduces latency, which increases mobile app response times.
- Business Resiliency for critical mobile apps

Infrastructure matters for mobile applications. The z Systems platform's scalability, security, and resilience can enhance critical mobile applications.

Why run Worklight Server on z Systems Linux?

For the same reasons you have run web apps there for over a decade:

- Co-location of the Worklight server application with data and transactions on z/OS **reduces the latency of access to z/OS data**. Hipersockets provides the lowest latency communication between Worklight apps and z/OS SOR. Hipersockets eliminates the need to encrypt traffic between Worklight and z/OS.
- Availability and scalability of Linux on z as an environment for both Worklight dev/test and production
- Hardware encryption speeds SSL applications
- All the traditional advantages of consolidating multiple distributed servers onto Linux on z -- reduce data center footprint, WAS software license savings, simpler management, energy savings

We recommend running Worklight Server in z Systems Linux for data-rich applications that will heavily leverage data and transactions from z/OS.

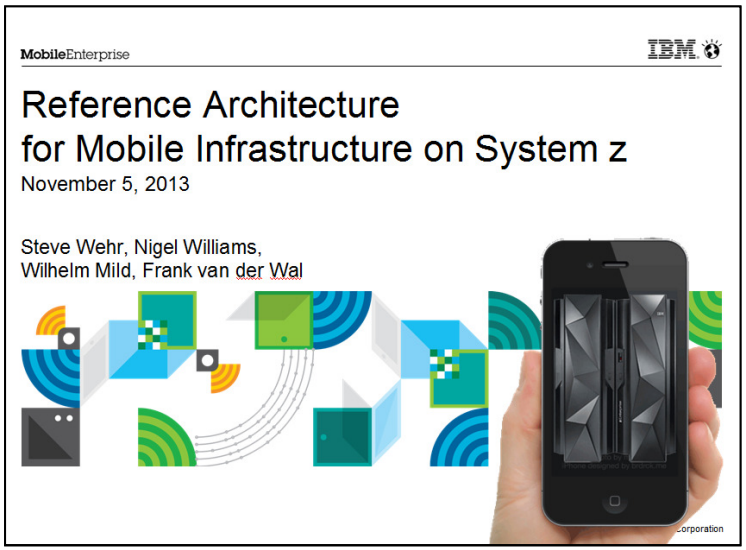
See this wiki for more rationale for WL on z.

Conclusion and Next Steps

Lab Services are ready to get you started

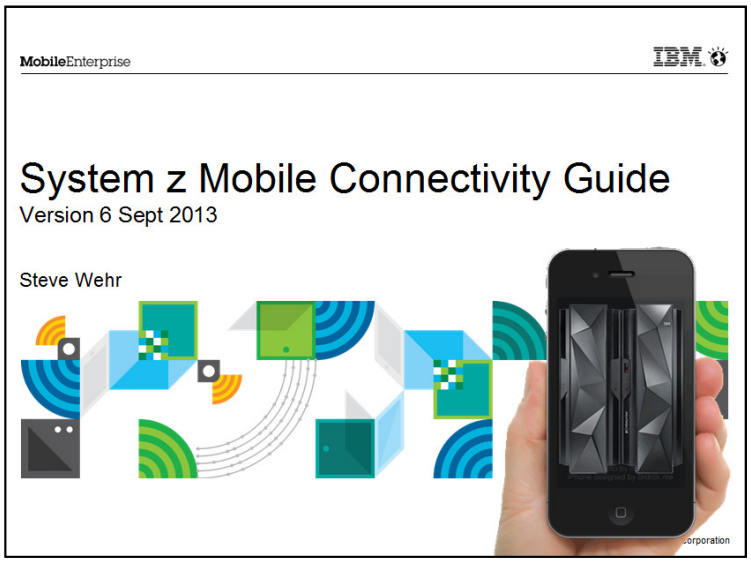
- **Worklight Mobile Jumpstart Services for z Systems**
  This Jumpstart services offering will allow you to exercise the different features of the Worklight platform as a first step in a larger deployment.
  - Predefined 1-2 week engagement
  - Create Worklight infrastructure and deploy a small sample application.
  - Integrate the worklight application with a z/OS service such as CICS.
- **Worklight Mobile Custom Services for z Systems**
  This is not a predefined service, but tailored offering that is customized for each projects specifics needs.
  - Custom services engagement tailored to customer needs.
  - Comprehensive services include
    - Design and architecture workshops
    - Implementation services for server infrastructure
    - Mobile application development and testing.
    - Enable and integrate to existing z/OS subsystem (such as CICS, IMS, or MQ)

Technical Collateral to start implementing Mobile on z



Contents

- Introduction, and major components of a mobile architecture.
- Mobile topology choices.
- Positioning for WebSphere Portal and Worklight.
- Architecture for Worklight Server in production.
- Architecture for Security
- Architecture for Worklight server in dev/test
- Scalability and performance considerations.
- Conclusion



Contents

- Summary of z mobile connectivity options, including Worklight
- Details
  - Push Notification
  - Why JSON
  - IBM API Management
  - CICS
  - IMS
  - DB2
  - WMB

Schedule an IBM On Ramp to Mobile Workshop

One day interactive workshop with an IBM Mobile expert to help enterprises plan and develop a customized roadmap for success

Workshop

For Line of business and IT leaders seeking expertise and experience in developing, enhancing, and/or executing their mobile enterprise strategy.

Client Value

- Industry expertise with top use cases and successes
- Capability assessment including identification of opportunities and gaps in mobile strategy
- A detailed client report and next steps

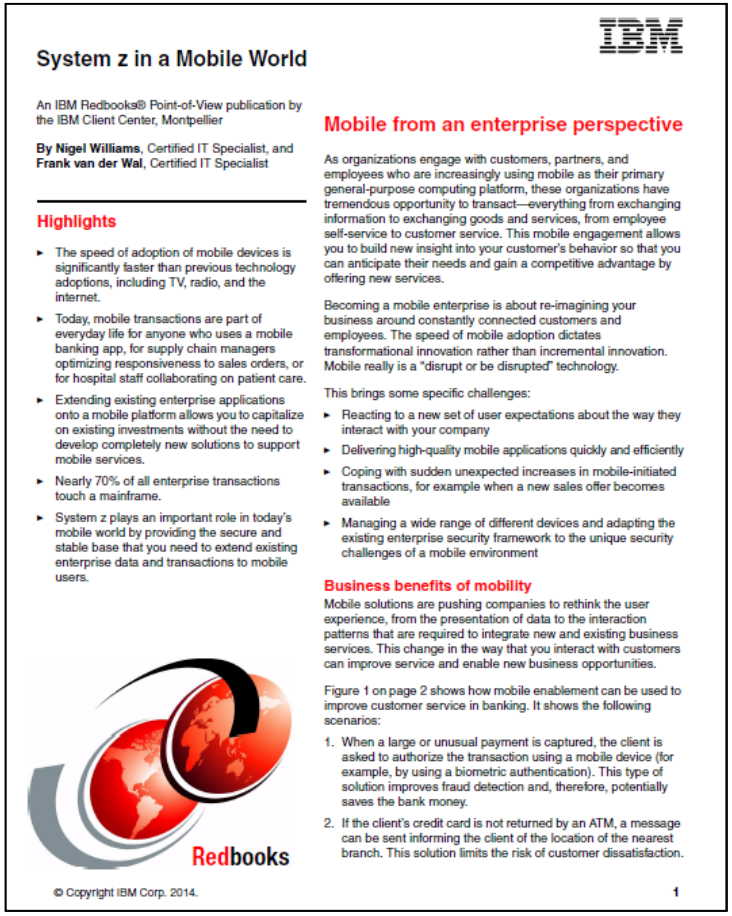
Highlights

- Interactive discussion to understand client business drivers, pains and requirements
- Overview of IBM MobileFirst Strategy, technology and POV's
- Industry trends and imperatives
- Structured working session to outline next steps

To schedule a workshop, email: ibmmobile@us.ibm.com

Interested? Next steps…

- Read our Point-of-View paper.
- Request a Demo.
  - Banking, Retail, Government, Insurance
  - Use Worklight on Linux on z Systems
  - Use z/OS transactions.
- Try the z Systems Mobile demo apps
  - CICS Genapp.
  - CICS EGUI
  - IBM Remote. Sample App you can use to manage z HMC.
- z Systems Mobile home page
  - Customer case studies
  - Analyst reports
  - Customer Videos.



System z in a Mobile World

An IBM Redbooks® Point-of-View publication by the IBM Client Center, Montpellier

By Nigel Williams, Certified IT Specialist, and **Frank van der Wal**, Certified IT Specialist

Highlights

- The speed of adoption of mobile devices is significantly faster than previous technology adoptions, including TV, radio, and the internet.
- Today, mobile transactions are part of everyday life for anyone who uses a mobile banking app, for supply chain managers optimizing responsiveness to sales orders, or for hospital staff collaborating on patient care.
- Extending existing enterprise applications onto a mobile platform allows you to capitalize on existing investments without the need to develop completely new solutions to support mobile services.
- Nearly 70% of all enterprise transactions touch a mainframe.
- System z plays an important role in today's mobile world by providing the secure and stable base that you need to extend existing enterprise data and transactions to mobile users.

Redbooks

Mobile from an enterprise perspective

As organizations engage with customers, partners, and employees who are increasingly using mobile as their primary general-purpose computing platform, these organizations have tremendous opportunity to transact—everything from exchanging information to exchanging goods and services, from employee self-service to customer service. This mobile engagement allows you to build new insight into your customer's behavior so that you can anticipate their needs and gain a competitive advantage by offering new services.

Becoming a mobile enterprise is about re-imagining your business around constantly connected customers and employees. The speed of mobile adoption dictates transformational innovation rather than incremental innovation. Mobile really is a "disrupt or be disrupted" technology.

This brings some specific challenges:

- Reacting to a new set of user expectations about the way they interact with your company
- Delivering high-quality mobile applications quickly and efficiently
- Coping with sudden unexpected increases in mobile-initiated transactions, for example when a new sales offer becomes available
- Managing a wide range of different devices and adapting the existing enterprise security framework to the unique security challenges of a mobile environment

Business benefits of mobility

Mobile solutions are pushing companies to rethink the user experience, from the presentation of data to the interaction patterns that are required to integrate new and existing business services. This change in the way that you interact with customers can improve service and enable new business opportunities.

Figure 1 on page 2 shows how mobile enablement can be used to improve customer service in banking. It shows the following scenarios:

1. When a large or unusual payment is captured, the client is asked to authorize the transaction using a mobile device (for example, by using a biometric authentication). This type of solution improves fraud detection and, therefore, potentially saves the bank money.
2. If the client's credit card is not returned by an ATM, a message can be sent informing the client of the location of the nearest branch. This solution limits the risk of customer dissatisfaction.

1

BACKUP

Detail on MobileFirst offerings

IBM MobileFirst Application & Data Platform

For clients who need to:

- Quickly develop and deploy high quality mobile apps across multiple platforms
- Seamlessly connect rich mobile applications to enterprise data and services
- Provide mobile collaboration within the enterprise

Key offerings:

- **IBM Worklight**
- IBM Rational Developer (and **RDz**)
- IBM Rational Test Workbench
- IBM MessageSight & MQTT
- **IBM Collaboration – Connections, Portal, Notes/Traveler**

IBM MobileFirst Platform offers:

- ✓ Native, web, or hybrid app development
- ✓ Tools to build & test high quality apps for many devices
- ✓ Management, security, continuous delivery & distribution of apps
- ✓ Easy connectivity to existing data & services for mobile usage
- ✓ On-premises or managed service delivery

IBM MobileFirst Management

For clients who need to:

- Implement BYOD with confidence
- Manage secure sensitive data, regardless of the device
- Manage, track and optimize mobile expenses
- Handle multi-platform complexities with ease

Key offerings:

- IBM Endpoint Manager for Mobile Devices
- Fiberlink Maas360
- IBM Emptoris Rivermine Telecom Expense Management
- IBM Mobile Enterprise Services for managed mobility

IBM MobileFirst Management offers:

- ✓ Unified management across devices
- ✓ Selective wipe of corporate data
- ✓ Configuration & enforcement of password policies, encryption, VPN access & camera use
- ✓ Streamlined workflow between development & operations with an integrated Enterprise App Store
- ✓ Optimize telecom expenses with detailed usage analyses
- ✓ End-user portal for management of mobile equipment, carrier plans, and usage tracking
- ✓ On-premises or managed service delivery

IBM MobileFirst Security

For clients who need to:

- Protect devices and data
- Defend the network
- Ensure secure access
- Safeguard mobile apps
- Preserve user experience without compromising security

Key offerings:

- IBM Security Access Manager for Cloud and Mobile
- IBM Security Appscan
- **zSecure**
- **QRadar**
- **Datapower XI50z**

IBM MobileFirst Security offers:

- ✓ Context aware risk – based access control
- ✓ Mobile threat protection
- ✓ Strong session management & Single Sign–on
- ✓ Vulnerability analysis for mobile apps
- ✓ Visibility and analysis of security events from the device, network, user end app behavior

IBM MobileFirst Analytics

For clients who need to:

- Optimize digital & mobile experiences to drive online conversion
- Analyze mobile behaviors and quantify business impact of user struggles
- Improve customer service resolution and drive loyalty

Key offerings:

- IBM Tealeaf CX Mobile
- **Cognos Mobile**

IBM MobileFirst Analytics offers:

- ✓ Automatic detection of customer issues through user and mobile device data
- ✓ User behavior drill down with high fidelity replay & reporting of the user experience
- ✓ Correlated customer behavior with network and application data
- ✓ High conversion and retention rates with quantifiable business impact analysis

IBM MobileFirst Strategy & Design Services

For clients who need to:

- Ensure mobile projects yield measurable business value
- Link mobile investments to ROI and IT strategy
- Establish plans for growth and maturity of mobile initiatives

Key offerings:

- Mobile Strategy Accelerator
- IBM Interactive
- IBM Mobile Infrastructure Strategy and Planning Services

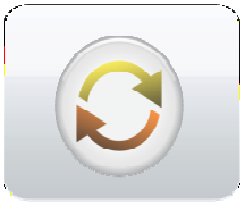
IBM MobileFirst Strategy & Design Services offer:

- ✓ Customer journey mapping for mobile engagement
- ✓ Accelerated mobile strategy & business case creation
- ✓ Vision and delivery of compelling mobile web experience
- ✓ Detailed strategies for infrastructure for mobile enterprise IT & communication initiatives

IBM MobileFirst Development & Integration Services

For clients who need to:

- Develop new mobile applications
- Integrate mobile applications with enterprise IT systems
- Manage and secure mobile environments
- Maintain visibility, control and automation of mobile devices



Key offerings:

- IBM Mobile Application Development from the Cloud
- IBM Mobile Application Management Services
- IBM Mobile Enterprise Services - Mobile Application Platform Management

IBM MobileFirst Development & Integration Services offer:

- ✓ Fast cycle development of mobile applications across platforms
- ✓ Mobile app integration for seamless connectivity and data management
- ✓ Secure and seamless wired, wireless, cellular and WiFi network access including increased network bandwidth required for voice, data and video
- ✓ Secure mobile device and application management

Cloud and Managed Services

For clients who need to:

- Manage complex IT infrastructures and/or multi vendor mobile environments
- Optimize IT resources across the extended enterprise
- Address shortages or gaps in mobile IT skills

Key offerings:

- IBM Mobile Enterprise Services for managed mobility
- IBM Mobile Application Development from the Cloud
- Fiberlink Maas360

IBM Cloud and Managed Services offer:

- ✓ Flexible and scalable compute power with access to greater network bandwidth
- ✓ Predictable allocation of, and investment in, current skills and IT resources that support mobile initiatives
- ✓ Multi-vendor integration and device support
- ✓ Highly efficient coordination of global mobile projects