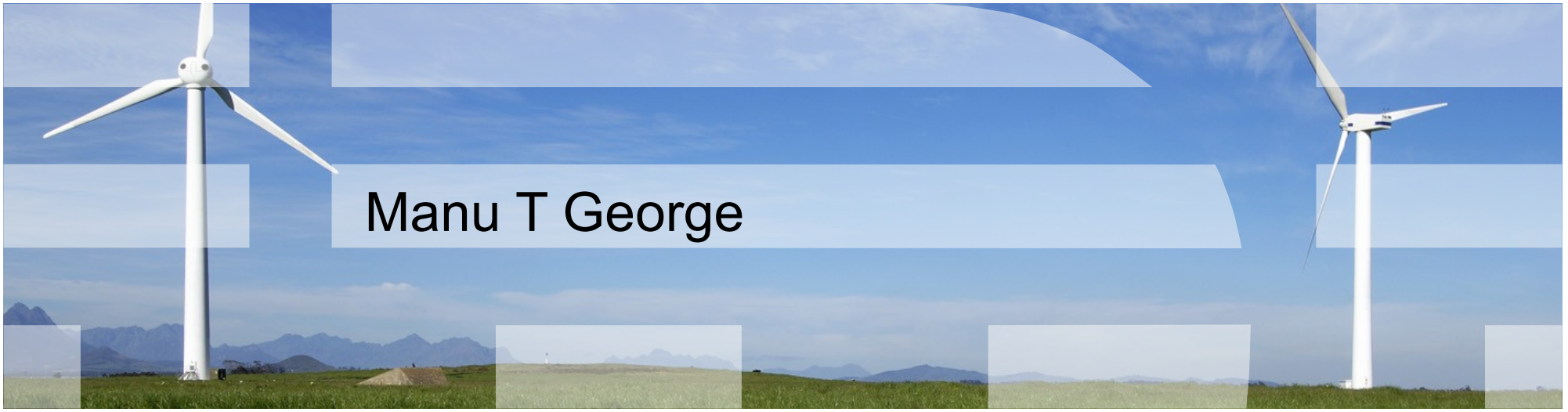
WebSphere Liberty Profile, A Better Alternative to Tomcat



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Agenda

- Introduction to the WebSphere Liberty Profile
- Comparison with Apache Tomcat

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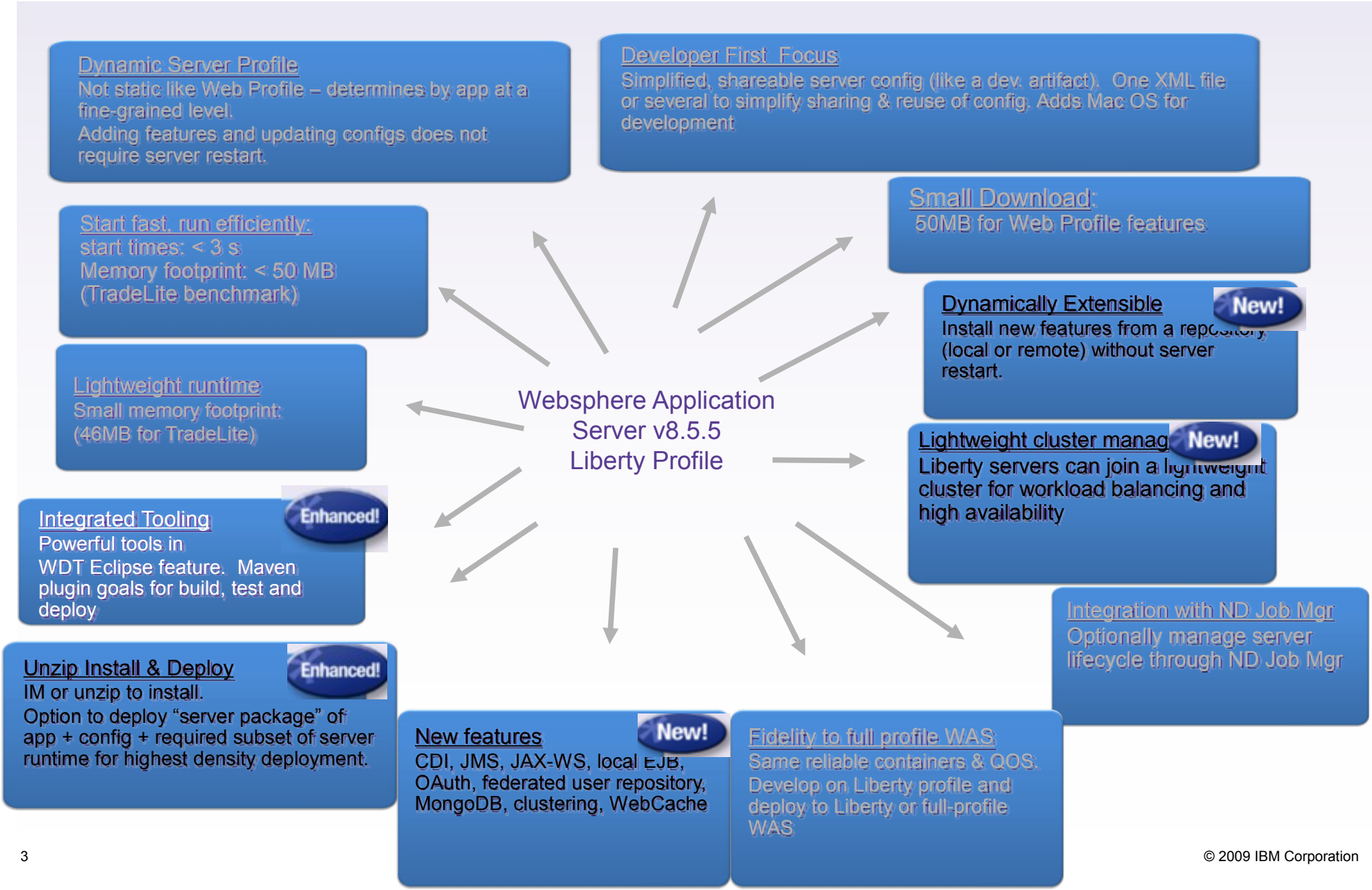
Introducing the Lightweight "Liberty" Profile

A highly composable, dynamic Server profile



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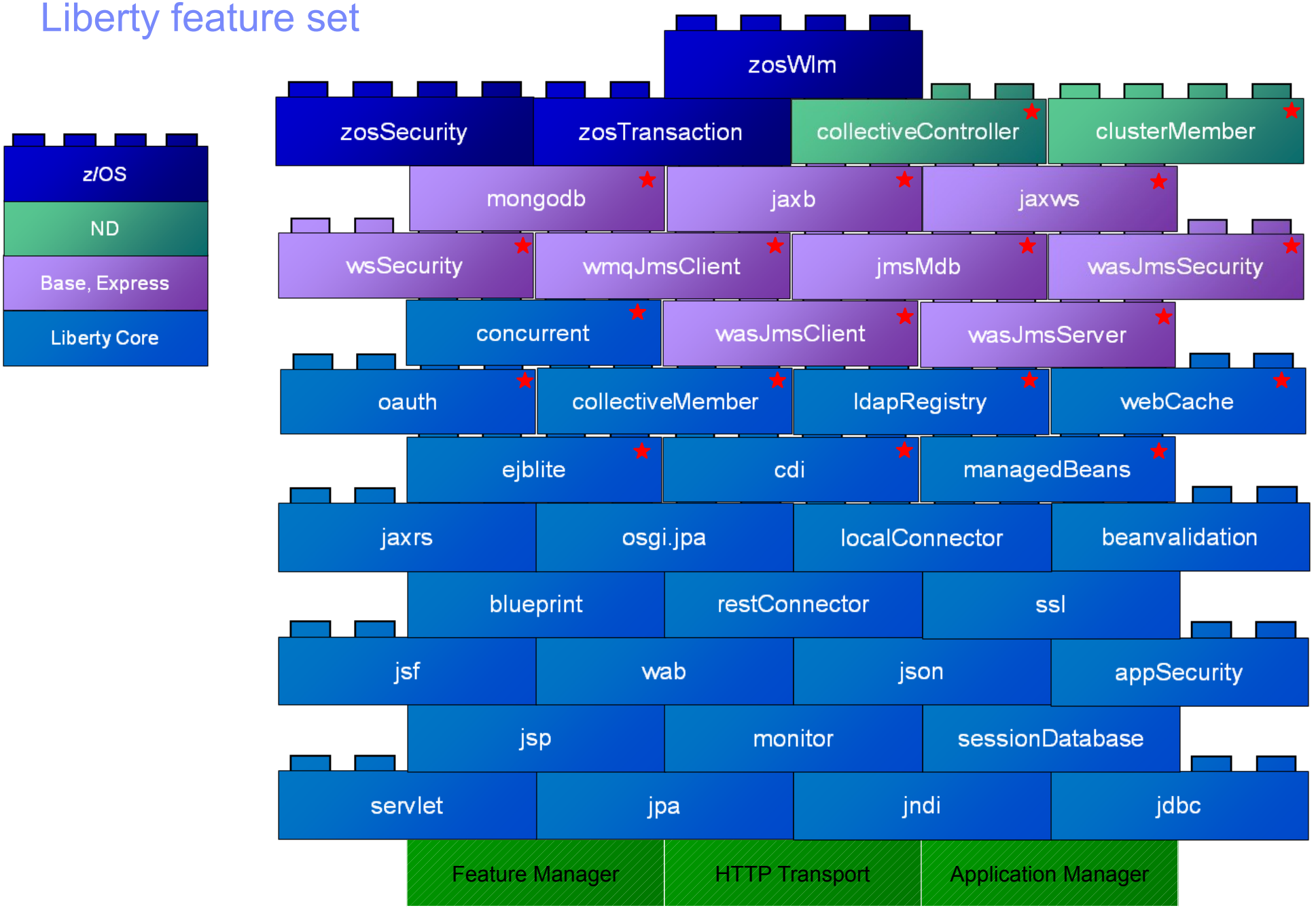
Liberty feature set



WAS v8.5 Liberty Profile (V8.5.5) ★

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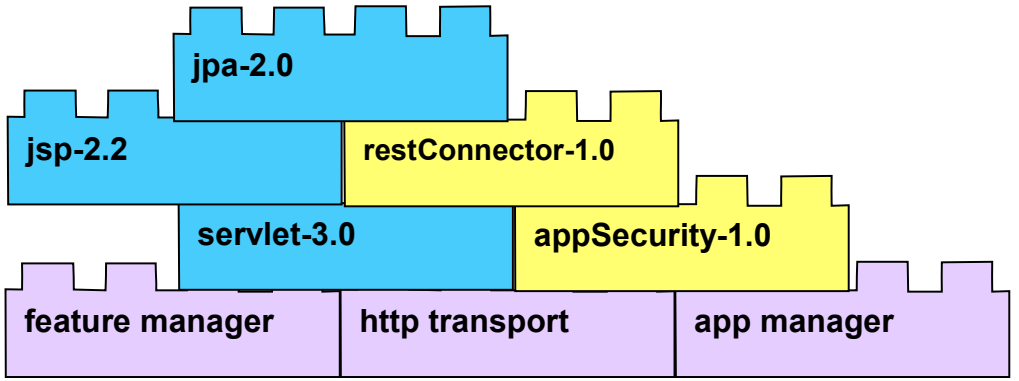
Highly Composable Runtime Based on Features

Full WAS Profile



WAS v8.5
Liberty Profile

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What is Tomcat

- Open Source Web Application Server from ASF.
- Catalina/Jasper/Coyote.
- No support for other services or application types beyond servlet/jsp.
- Developers need to integrate 3rd party components to extend functionality and that will over time result in a homegrown Tomcat kitchen sink type server..
- Web container for WebSphere Community Edition and not other WebSphere versions.

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Installation

- Liberty
  - One click download from wasdev.net
  - 50 MB installable/zip
  - Java EE Web Profile support
  - Need only a single installation only for creating multiple servers
  - IM based install
  - Default server created on first use of the server command
  - Remote installs via Job Manager
  - Upgradable via IM or by manually obtaining a newer distribution archive.
  - Existing configuration can be used without changes

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Installation

- Tomcat
  - Downloadable as zip file from Apache
  - 8 MB zip file
  - Only supports servlets and jsps out of the box
  - To run multiple servers multiple replicas are needed or new scripts for startup and shutdown
  - No IM based install
  - Need 3rd party jars for matching functionality
  - Installation includes a default server configuration.
  - Manual upgrades.
  - Individual compatibility checks and upgrades for 3rd party jars.

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Development Environment

- Liberty
  - WDT available for free from the eclipse marketplace or wasdev.net.
  - Can be installed via eclipse update
  - Eclipse plugin that provides a lightweight set of tools for developing, assembling and deploying applications to Liberty
  - Tools plugin can also download and install the runtime
  - Extensive integration between tools and runtime
  - Form based config editor
  - Support for runtime utilities such as package, generation of plugin-cfg.xml, SSL certificate generation and dump.
  - Shared library support.
  - Support for managing multiple runtimes, servers and shared configuration snippets.

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Development Environment

- Liberty
  - Enhanced Java EE tools including form based editors for data-definition and JPA, Enterprise Navigator, validation and quick fixes.
  - Web and mobile tools including a rich page editor, Dojo support, improved JavaScript tools and debug abilities.
  - Full OSGI developer tools, including blueprint and application editors, along with bundle dependency viewer.
  - WebSphere Application Server programming model support, including JPA, form based bindings and extensions editors

- Tomcat
  - Part of default list of servers available for eclipse for Java EE developers.
  - Point eclipse to existing Tomcat installation or download and install from eclipse

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Configuration

- Liberty
  - Sparse configuration with built in configuration defaults
  - Addition of new features by adding a single line in config
  - Single configuration file in server.xml
  - Changes to configuration are picked up at runtime and do not need a server restart

- Tomcat
  - Fully configured file provided
  - Remove unwanted config before deploying applications to disable unwanted features
  - Single configuration file in server.xml
  - Changes to configuration are not picked up at runtime and need a server restart

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Application Deployment

- Both Liberty and Tomcat have similar deployment experience.
- Both provide server specific application programming interfaces that go beyond Java EE.
- Applications using WebSphere APIs provided by Liberty can run on the full profile
- Liberty does not need a restart for any changes made to config or the application while tomcat needs a restart for config changes.
- Monitored directory available in both Liberty(dropins) and Tomcat(webapp). Tomcat supports wars while Liberty supports other application types like ears and wabs.
- Applications can also be defined in server.xml
- Loose config support support provided in Liberty

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Provisioning

- Liberty, by design, allows you to include only the features you need for your applications .
- Liberty "minify" will subset the runtime for you, based on the configuration of the server
- produces a deployable binary server
- Tomcat is monolithic, will require significant manual effort and testing to figure out how to get back to "right-sized" server environment for homegrown kitchen sink servers.

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Data Access

- Liberty
  - Out of the box support for XA Transactions.
  - Support for XA Transactions via WebSphere Transaction manager.
  - Support for JPA can be enabled by adding the jpa-2.0 feature
  - Support for both container managed and application managed JPA.
  - OpenJPA is integrated with Liberty
  - Jdbc-4.0 feature for enabling access to database with robust connection management provided by WebSphere Application Server.

- Tomcat
  - No native support for JTA.
  - Third party transaction managers must be used like Apache Geronimo Transaction Manager or JOTM
  - No JPA functionality available out of the box and the user has to integrate a JPA provider like OpenJPA
  - Tomcat JDBC connection pooling, also possible to plugin a custom connection pool by rolling your own custom resource factory

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Security

- Liberty
  - Security enabled via appSecurity-2.0 feature.
  - Support for Basic, LDAP and custom user registries
  - Support for Oauth
  - Support for password hashing, and password encryption in server.xml
  - Support for JAAS LoginModules
  - Support for SSO and TAI
  - Seamless integration with other authentication and authorization products

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Security

- Tomcat
  - Provides multiple interfaces to enable security namely
    - MemoryRealm
    - JDBCRealm
    - DataSourceRealm (small-scale relatively static environments)
    - UserDatabaseRealm
    - JAASRealm (Not mature)
    - JNDIRealm
  - Realms do not support account lockout by default. Chosen realm should be wrapped in a LockOutRealm to prevent brute force attacks
  - No built-in support for SSO and TAI.
  - No built-in OAuth support. Integration with third party Oauth providers like Oltu.
  - Results in a homegrown hode podge of custom integration with different vendors.

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Shared Libraries

- Liberty
  - Supports three types of shared libraries, global, common and private libraries.
  - Global shared libraries can be placed at <liberty-install-dir>/usr/shared/lib/global.
  - Global shared libraries allow all applications to share a common instance of the library
  - Common shared libraries make it possible for specific applications to share a common instance of the library
  - Private shared libraries are specific to an application

- Tomcat
  - Only support global shared libraries.
  - Does not allow different versions of the same library

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OSGI Applications

- Liberty
  - Built on an OSGI Framework and supports OSGI Applications
  - WAB and EBA are supported as application types

- Tomcat
  - Not an OSGI container and does not support OSGI applications.

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z/OS Integration

- Liberty
  - Start stop or modify the Liberty profile by using IBM MVS operator commands.
  - Support for RACF user registry, SAF keyring and SAF authorization
  - Support for RRS transactions in z/OS

- Tomcat
  - No native support
  - Can use third party tools like T:Z

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Troubleshooting

- Liberty
  - Provides a unified logging component
  - Base implementation of Trace and FFDC
  - Intercepts OSGI and java logging output. Apps can log using virtually any logging framework.
  - Individual logs for each server instance
  - HPEL support
  - Each Liberty server produces its own logging, trace and FFDC information in the <libertyinstall>/usr/servers/<servername>/logs directory.
  - Possible to dump server status via the dump command to capture the state of a server
    - State of each OSGi bundle in the server
    - Wiring information for each OSGi bundle in the server
    - Component list managed by the Service ComponentRuntime (SCR)
    - Detailed information of each component from SCR
    - Thread dump

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Troubleshooting

- Tomcat
  - The Tomcat server produces several logging outputs in the<tomcat-installation>/logs directory.
  - Additional log files are produced for installed third party libraries like OpenJPA
  - Web applications can use virtually any logging framework
  - Log level configured in server.xml but 3rd party libraries may need other files to be modified
  - Non integrated logs make troubleshooting difficult.
  - No built in functionality to do a server dump. Similar information can be gathered manually by sending a SIGBREAK signal to the JVM.

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Monitoring and Management

- Liberty
  - Provides JMX Mbeans deployed by default for monitoring and management.
  - Implicitly secured local connector and security rich remote REST connector
  - Users can develop and deploy custom Mbeans
  - Can be administered from Job Manager/Deployment Manager console.
  - Supports automated install/uninstall/stop/start for a group of host machines
  - Supports creation of an embedded server that contains the server, deployed apps and configuration.

- Tomcat
  - Provides JMX Mbeans deployed by default
  - Local and Remote connectors can be secured by editing the JAVA_OPTS environment variable
  - Users can develop and deploy custom Mbeans
  - Need to purchase 3rd party tools like mulesoft Tcat for production deployment, centralized application management, security, diagnostics and configuration management.

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Scaling

- Liberty
  - Provides HTTP clustering and Load Balancing via the web server plugin.
  - plugin-cfg.xml can be generated by defaultPluginConfig generation Mbean.
  - Plugin provides workload balancing, session affinity and persistence of session state to database for failover.
  - Enhanced capabilities with Extreme Scale for HTTP session persistence
  - Dynacache support.
  - Application Server Clustering support with ND and z/OS versions via collectives.
  - Administration of a collective possible via Collective Controller. (stop/start/updateConfig)
  - Cluster administration via the ClusterManager Mbean.
  - Plugin generation for the cluster via the ClusterManager Mbean.

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Scaling

- Tomcat
  - Easily possible to configure a cluster which by default enables all to all session replication using DeltaManager which is not scalable
  - You can have replication to only one other node via BackupManager but its not battle tested like DeltaManager
  - Load balancing provided by Apache HTTP Server configured with the mod_proxy module.
  - Extreme scale supports Tomcat.

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Extensibility

- Liberty can be extended by creating custom user defined features
- Features are treated as an integrated part of the runtime getting access to server SPIs that applications do not have access to.
- Features are installed and managed separately from business applications, keeping your run time or product code separate from user code.
- Services provided by user specified features can get user specified configuration from server.xml
- Extensions can be added to /usr/extensions.
- Tooling will also automatically support feature extensions
- Tomcat extensions can be done by adhoc integration of 3rd party jars.

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Licensing and Support

- Liberty is fully supported by IBM.
- Tomcat support is provided by certain firms, however any 3rd party extensions or jars used with Tomcat would require support from other entities. OSS communities support is on a best effort basis.
- Liberty has strict backward compatibility requirements in service.
  - No regressions on service releases
  - New behaviors in service should be intentionally enabled by the customer
- Open Source communities may not adhere to strict backward compatibility
- IBM Vets all the OSS that is delivered with Liberty as well as all IBM code.
- With OSS it is customers responsibility

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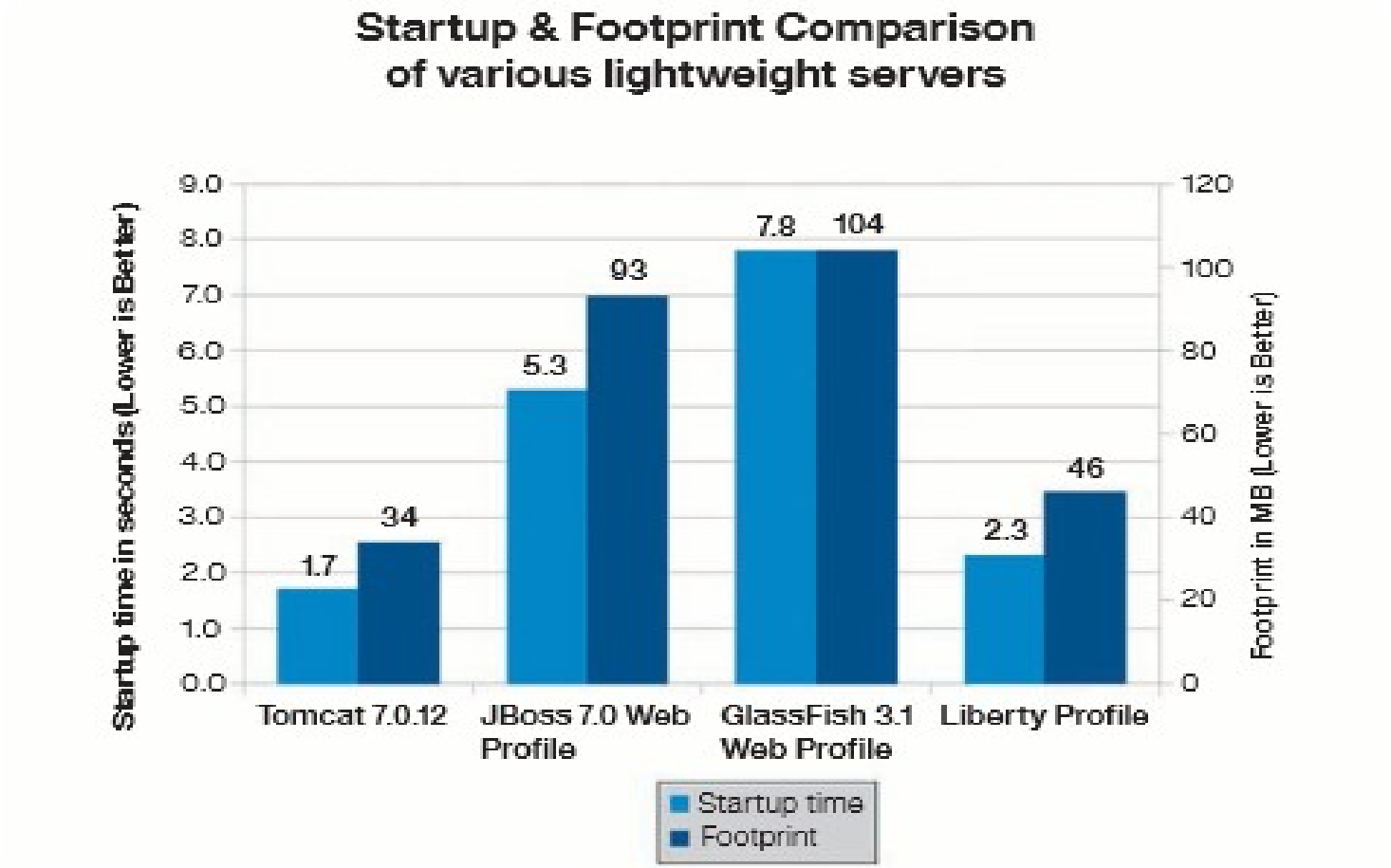
Performance



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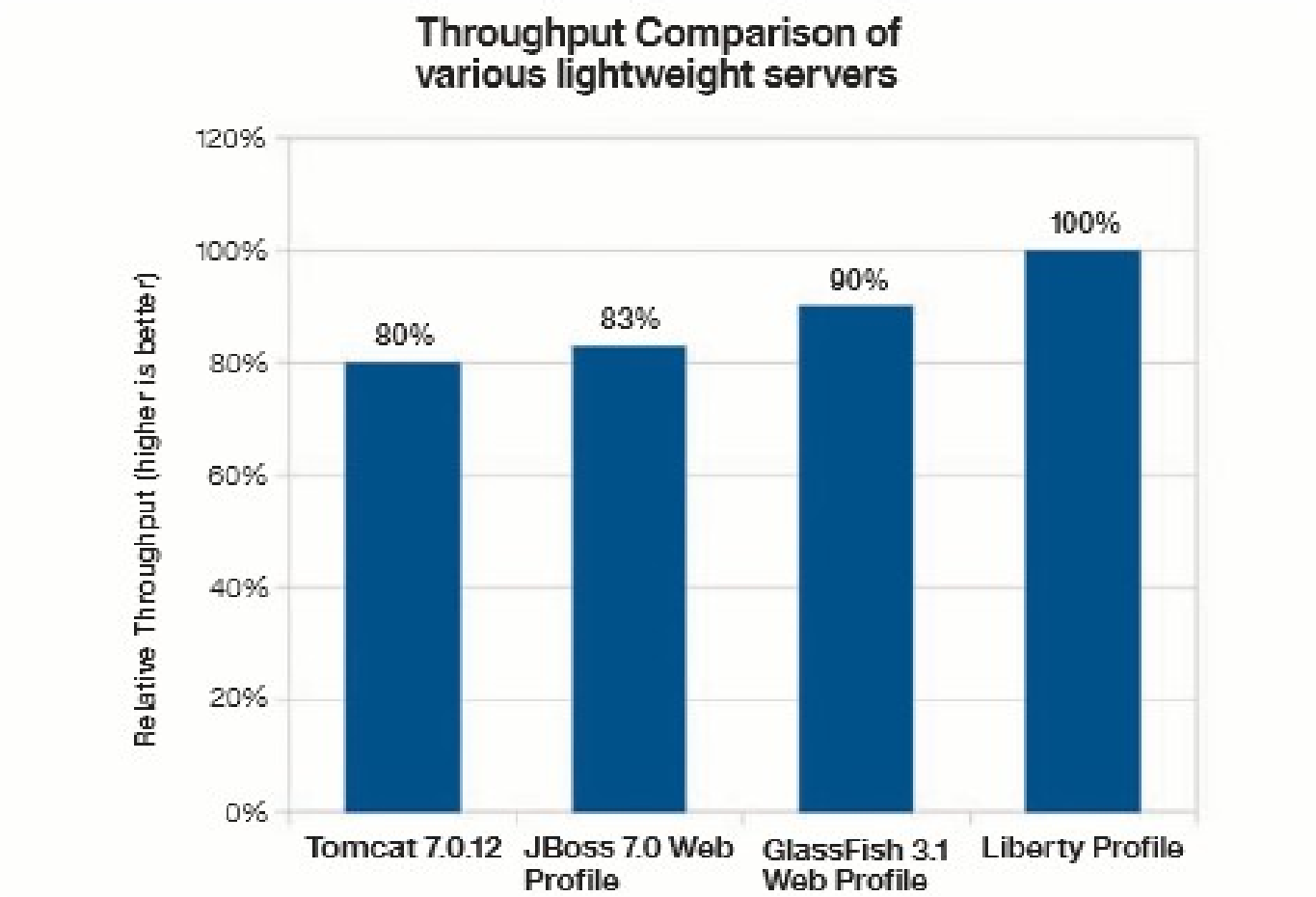
Performance



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Feature Comparison

Functionality	Liberty	Tomcat	Notes
Servlet 3.0	Yes	Yes	
JSP 2.2	Yes	Yes	
Secure Socket Layer (SSL)	Yes	Yes	
Federal Information Processing Standard (FIPS) 140-2	Yes	Yes	
FIPS 800-331	Yes	No	
Java Database Connectivity (JDBC)	Yes	Yes	
Lightweight Directory Access Protocol (LDAP)	Yes	Yes	
Java Naming and Directory Interface (JNDI)	Yes	Yes	
Java Management Extensions (JMX)	Yes (1)	Yes	1. has local and remote REST connectors
Shared libraries	Yes	Yes	Different Concepts
Servlet security	Yes	Yes	
JavaServer Faces (JSF)	Yes	No (2)	2. Apache Myfaces

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Feature Comparison

Functionality	Liberty	Tomcat	Notes
Java Persistence API (JPA)	Yes	No (3)	3. Apache OpenJPA
Java Transaction API (JTA)	Yes	No (4)	4. Apache Geronimo TM, JOTM
Web archive (WAR) application	Yes	Yes	
Enterprise archive (EAR)	Yes	No (5)	5. Apache OpenEJB
Web Application Bundle (WAB)	Yes	No (6)	6. Only in Apache Geronimo
Enterprise Bundle Archive (EBA)	Yes	No (7)	7. Only in Apache Geronimo
Bean validation	Yes	No (8)	8. Apache Bean Validation
IBM z/OS® support	Yes	No (9)	9. Dovetailed Technologies T:Z
iSeries support	Yes	Yes	

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JVM Comparisons

Function	Liberty Profile (IBM J9)	Tomcat (Hotspot Open JDK)	Notes
Faster garbage collection for large heap sizes (>4 GB) -xgcpolicy: balanced	Yes	No	
System-class data sharing for reduced memory usage and faster startup	Yes	Yes (1)	1. Client only
Application-class data sharing for smaller memory usage and faster startup	Yes	No	
JVM restarted when PermGen fills up	Yes	No	
Compressed 64-bit references for faster runtime and smaller memory	Yes	Yes (2)	2. Recent addition
Dump analyzer for hang, crash and memory management	Yes	Yes	IBM's dump analyzer is better
Garbage collection and memory visualizer for monitoring memory usage and performance	Yes	No	
Memory analyzer for troubleshooting memory leaks and excessive heap consumption	Yes	Yes	
Health center for near-real time monitoring of running virtual machines	Yes	No	

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Key Takeaways

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Thank You

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