

Technology Selection Document

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1 GSA Application Inventory Analysis/Notional Evaluation

Proprietary RDBMS to Open Source RDBMS

Name	Current Technologies	Future Technologies
8(a) STARS II Pricing Tool	JBoss jBPM Apache HTTP Server 2.2 Oracle Java Enterprise Edition 7 Mozilla Foundation Javascript 1 Groovy 2 Red Hat Enterprise Linux 6 Red Hat Enterprise Linux 7.1 Oracle Database 11g	Boss jBPM Apache HTTP Server 2.2 Oracle Java Enterprise Edition 7 Mozilla Foundation Javascript 1 Groovy 2 Red Hat Enterprise Linux 6 Red Hat Enterprise Linux 7.1 MySQL/PostgreSQL
AAC Inquiry - Activity Address Code Inquiry	Java Sybase Adaptive Server Enterprise 15 JBoss ESB W3C HTML 5 ISO/IEC SQL 2008 Red Hat Enterprise Linux 6 Apache HTTP Server 2.2 Oracle Java SE JDK 7 Oracle Java SE JDK 8 Red Hat Enterprise Linux 7.1	Java Sybase Adaptive Server Enterprise 15 JBoss ESB W3C HTML 5 ISO/IEC SQL 2008 Red Hat Enterprise Linux 6 Apache HTTP Server 2.2 Red Hat Enterprise Linux 7.1
AAMS - Agency Asset Management System	Unisys DMSII COBOL 2002 W3C HTML 5 Java Oracle Java SE JDK 7 Oracle Java SE JDK 8 W3C Extensible Markup Language (XML) 1 ALGOL 68 W3C Web Services Description Language (WSDL) 2 Work Flow Language (WFL) Decision Support Inc URSA Major 11.1.x Mozilla Foundation Javascript 1 WebPCM DBATools Cascading Style Sheets (CSS) COMS JSON	Unisys DMSII W3C HTML 5 Java Oracle Java SE JDK 7 Oracle Java SE JDK 8 W3C Extensible Markup Language (XML) 1 ALGOL 68 W3C Web Services Description Language (WSDL) 2 Work Flow Language (WFL) Decision Support Inc URSA Major 11.1.x Mozilla Foundation Javascript 1 WebPCM DBATools Cascading Style Sheets (CSS) COMS JSON

ACIS - Advantage Customer Information System	Java Sybase Adaptive Server Enterprise 15 JBoss ESB Apache HTTP Server 2.2 Red Hat Enterprise Linux 6 Oracle Java SE JDK 7 Oracle Java SE JDK 8 Red Hat Enterprise Linux 7.1	Java Sybase Adaptive Server Enterprise 15 JBoss ESB Apache HTTP Server 2.2 Red Hat Enterprise Linux 6 Oracle Java SE JDK 7 Oracle Java SE JDK 8 Red Hat Enterprise Linux 7.1 JBoss ESB
AMP/CAM - Acquisition Management Program/Customer Acquisition Module	W3C Cascading Style Sheets 2 JBoss 5.2 Unisys DMSII jQuery 2 Unisys Programmer's Workbench 54 Adobe Dreamweaver 10 COBOL 85 Oracle Java SE JDK 7 Oracle Java SE JDK 8 W3C HTML 5 W3C Extensible Markup Language (XML) 1 ALGOL 68 W3C Web Services Description Language (WSDL) 2 Work Flow Language (WFL) Decision Support Inc URSA Major 11.1.x Mozilla Foundation Javascript 1 WebPCM CANDE DBATools Cascading Style Sheets (CSS) COMS jQuery 1 JSON	W3C Cascading Style Sheets 2 JBoss 5.2 Unisys DMSII jQuery 2 Unisys Programmer's Workbench 54 Oracle Java SE JDK 7 Oracle Java SE JDK 8 W3C HTML 5 W3C Extensible Markup Language (XML) 1 ALGOL 68 W3C Web Services Description Language (WSDL) 2 Work Flow Language (WFL) Decision Support Inc URSA Major 11.1.x Mozilla Foundation Javascript 1 WebPCM CANDE DBATools Cascading Style Sheets (CSS) COMS jQuery 1 JSON
ARTS - Accounts Receivable Tracking System	Oracle Java SE JDK 7 Oracle Java SE JDK 8 MySQL AB MySQL 5 (Enterprise Edition) Java JBoss 5.2	Oracle Java SE JDK 7 Oracle Java SE JDK 8 MySQL AB MySQL 5 (Enterprise Edition) Java JBoss 5.2
ASAP - Advantage Spend Analysis Program	Sybase IQ 16.0 SAP BusinessObjects XI 4 JBoss jBPM Apache HTTP Server 2.2 Oracle Java Enterprise Edition 7 Microsoft SQL Server 2010 Red Hat Enterprise Linux 6	Sybase IQ 16.0 SAP BusinessObjects XI 4 JBoss jBPM Apache HTTP Server 2.2 Oracle Java Enterprise Edition 7 Microsoft SQL Server 2010

	Oracle Solaris 10 Oracle Java SE JDK 7 Oracle Java SE JDK 8 Microsoft .NET Framework 4.5 Red Hat Enterprise Linux 7.1	Red Hat Enterprise Linux 6 Oracle Solaris 10 Oracle Java SE JDK 7 Oracle Java SE JDK 8 Microsoft .NET Framework 4.5 Red Hat Enterprise Linux 7.1
ASPA - Application System for Post-Payment Audits	Oracle Java SE JDK 7 Oracle Java SE JDK 8 W3C HTML 5 Unisys ClearPath ePortal Developer 5 Universal Report Specifying Application 9.0 Mozilla Foundation Javascript 1 Unisys MCP 13 Unisys DMSII Microsoft Windows 2000 Server Standard Microsoft Visual Studio 2005 JQuery 2 JQuery 1	Oracle Java SE JDK 7 Oracle Java SE JDK 8 W3C HTML 5 Unisys ClearPath ePortal Developer 5 Universal Report Specifying Application 9.0 Mozilla Foundation Javascript 1 Unisys MCP 13 Unisys DMSII Microsoft Visual Studio 2005 JQuery 2 JQuery 1
ASSIST - Assisted Services Shared Information SysTem Portal	JBoss jBPM JBoss 5.2 Microsoft Windows 2003 Server R2 Enterprise Spring Framework 4 Oracle Database 10g SAP BusinessObjects XI 4 Oracle Database 11g Red Hat Enterprise Linux 4 Red Hat Enterprise Linux 5 BIRT v4.0	JBoss jBPM JBoss 5.2 Enterprise Spring Framework 4 SAP BusinessObjects XI 4 Red Hat Enterprise Linux 4 Red Hat Enterprise Linux 5 BIRT v4.0
AutoChoice	Unisys DMSII JBoss 5.2 Oracle Java SE JDK 7 Oracle Java SE JDK 8 Spring Framework 4 Apache Tomcat 2.0 JavaServer Pages 2.0 Red Hat Hibernate ORM 3 Spring Framework 3	Unisys DMSII JBoss 5.2 Oracle Java SE JDK 7 Oracle Java SE JDK 8 Spring Framework 4 Apache Tomcat 2.0 JavaServer Pages 2.0 Red Hat Hibernate ORM 3 Spring Framework 3
AutoChoice	MySQL AB MySQL 5 (Enterprise Edition) Jinfonet JReport 13.1 W3C Cascading Style Sheets 2 JBoss 5.2 Oracle Java SE JDK 7 Oracle Java SE JDK 8 Eclipse Classic 4	MySQL AB MySQL 5 (Enterprise Edition) Jinfonet JReport 13.1 W3C Cascading Style Sheets 2 JBoss 5.2 Oracle Java SE JDK 7 Oracle Java SE JDK 8 Eclipse Classic 4
AutoVendor	MySQL AB MySQL 5 (Enterprise Edition) Jinfonet JReport 13.1	MySQL AB MySQL 5 (Enterprise Edition)

	W3C Cascading Style Sheets 2 JBoss 5.2 Oracle Java SE JDK 7 Oracle Java SE JDK 8 Eclipse Classic 4	Jinfony JReport 13.1 W3C Cascading Style Sheets 2 JBoss 5.2 Oracle Java SE JDK 7 Oracle Java SE JDK 8 Eclipse Classic 4
AWM - Acquisition Workflow Manager	Salesforce Force.com Oracle APEX 4 Mozilla Foundation Javascript 1 jQuery 2 jQuery 1	Salesforce Force.com Oracle APEX 4 Mozilla Foundation Javascript 1 jQuery 2 jQuery 1
CFL - Computers For Learning	Unisys DMSII Work Flow Language (WFL) W3C HTML 5 COBOL 2002 jQuery 2 Java COBOL 85 Oracle Java SE JDK 7 Oracle Java SE JDK 8 W3C Extensible Markup Language (XML) 1 ALGOL 68 W3C Web Services Description Language (WSDL) 2 Decision Support Inc URSA Major 11.1.x Mozilla Foundation Javascript 1 WebPCM DBATools Cascading Style Sheets (CSS) COMS jQuery 1 JSON	Unisys DMSII Work Flow Language (WFL) W3C HTML 5 jQuery 2 Java Oracle Java SE JDK 7 Oracle Java SE JDK 8 W3C Extensible Markup Language (XML) 1 ALGOL 68 W3C Web Services Description Language (WSDL) 2 Decision Support Inc URSA Major 11.1.x Mozilla Foundation Javascript 1 WebPCM DBATools Cascading Style Sheets (CSS) COMS jQuery 1 JSON
CMLS - Centralized Mailing List Service (SF)	Salesforce Force.com W3C Cascading Style Sheets 2 Oracle APEX 4	Salesforce Force.com W3C Cascading Style Sheets 2 Oracle APEX 4
CORS - Contracting Officer Review System	Sybase Adaptive Server Enterprise 15 JBoss jBPM Apache Solr 4 Apache HTTP Server 2.2 Oracle Java Enterprise Edition 7 Oracle Java SE JDK 1.4 Red Hat Enterprise Linux 6 Oracle Java SE JDK 7 Oracle Java SE JDK 8 Red Hat Enterprise Linux 7.1	Sybase Adaptive Server Enterprise 15 JBoss jBPM Apache Solr 4 Apache HTTP Server 2.2 Oracle Java Enterprise Edition 7 Oracle Java SE JDK 1.4 Red Hat Enterprise Linux 6 Oracle Java SE JDK 7

		Oracle Java SE JDK 8 Red Hat Enterprise Linux 7.1
CPARS - Contractor Performance Assessment Reports System	Oracle Java SE JDK 7 Oracle Java SE JDK 8 Apache Tomcat 7.0 Apache Tomcat 6.0 Apache HTTP Server 2.2 Microsoft Windows Storage Server 2008 R2	Oracle Java SE JDK 7 Oracle Java SE JDK 8 Apache Tomcat 7.0 Apache Tomcat 6.0 Apache HTTP Server 2.2
CPRM - Contractor Payment Reporting Module	Apache HTTP Server 1 IBM Lotus Domino 8 Microsoft Windows 2003 Server R2 Enterprise Oracle Database 10g Oracle Database 11g Red Hat Enterprise Linux 4 Red Hat Enterprise Linux 5	Apache HTTP Server 1 IBM Lotus Domino 8 Red Hat Enterprise Linux 4 Red Hat Enterprise Linux 5
Cross Training	Salesforce Force.com Oracle APEX 4 Mozilla Foundation Javascript 1 jQuery 2 jQuery 1	Salesforce Force.com Oracle APEX 4 Mozilla Foundation Javascript 1 jQuery 2 jQuery 1
DRM - Dispatch Reservation Module	Unisys DMSII Unisys Programmer's Workbench 54 W3C Cascading Style Sheets 2 Adobe Dreamweaver 10 COBOL 85 Oracle Java SE JDK 7 Oracle Java SE JDK 8 W3C HTML 5 W3C Extensible Markup Language (XML) 1 ALGOL 68 W3C Web Services Description Language (WSDL) 2 Work Flow Language (WFL) Decision Support Inc URSA Major 11.1.x Mozilla Foundation Javascript 1 Unisys MCP 16 jQuery 2 WebPCM CANDE DBATools Cascading Style Sheets (CSS) COMS jQuery 1 JSON	Unisys DMSII Unisys Programmer's Workbench 54 W3C Cascading Style Sheets 2 Adobe Dreamweaver 10 Oracle Java SE JDK 7 Oracle Java SE JDK 8 W3C HTML 5 W3C Extensible Markup Language (XML) 1 ALGOL 68 W3C Web Services Description Language (WSDL) 2 Work Flow Language (WFL) Decision Support Inc URSA Major 11.1.x Mozilla Foundation Javascript 1 Unisys MCP 16 jQuery 2 WebPCM CANDE DBATools Cascading Style Sheets (CSS) COMS

		JQuery 1 JSON
eBuy	Sybase Adaptive Server Enterprise 15 SAP BusinessObjects XI 4 Sybase IQ 16.0 Oracle Java Enterprise Edition 7 JBoss jBPM W3C HTML 5 Apache Solr 4 Apache HTTP Server 2.2 Microsoft SQL Server 2010 Spring Framework 4 Apache Struts 1 Red Hat Enterprise Linux 6 Red Hat Enterprise Linux 7.1	Sybase Adaptive Server Enterprise 15 SAP BusinessObjects XI 4 Sybase IQ 16.0 Oracle Java Enterprise Edition 7 JBoss jBPM W3C HTML 5 Apache Solr 4 Apache HTTP Server 2.2 Microsoft SQL Server 2010 Spring Framework 4 Apache Struts 1 Red Hat Enterprise Linux 6 Red Hat Enterprise Linux 7.1
EC/EDI/FAX Gateway	Oracle Java SE JDK 7 Oracle Java SE JDK 8 ANSI/ISO C++ 2011 ANSI/ISO C 11 Oracle Solaris 10 Microsoft SQL Server 2012 PERL 5 Red Hat Enterprise Linux 5 Red Hat Enterprise Linux 6 Oracle Database 11g Sybase IQ 15.0 Red Hat Enterprise Linux 7.1 JBoss 5.2	Oracle Java SE JDK 7 Oracle Java SE JDK 8 ANSI/ISO C++ 2011 Oracle Solaris 10 Microsoft SQL Server 2012 PERL 5 Red Hat Enterprise Linux 5 Red Hat Enterprise Linux 6 Sybase IQ 15.0 Red Hat Enterprise Linux 7.1 JBoss 5.2
eOffer/eMod - Electronic Offers/Electronic Modifications	Oracle Database 11g Red Hat Enterprise Linux 5 Apache HTTP Server 2.2 Microsoft Windows 7 (6.0) JBoss 5.2 Sybase Adaptive Server Enterprise 15 Eclipse Classic 4 Oracle Java SE JDK 7 Mozilla Foundation Javascript 1	Red Hat Enterprise Linux 5 Apache HTTP Server 2.2 JBoss 5.2 Sybase Adaptive Server Enterprise 15 Eclipse Classic 4 Oracle Java SE JDK 7 Mozilla Foundation Javascript 1
eViewer	EMC Documentum 6 JBoss 5.2 Apache HTTP Server 2.2 Oracle Database 11g Oracle Java SE JDK 7 Oracle Java SE JDK 8 EMC Documentum Content Server 4	EMC Documentum 6 JBoss 5.2 Apache HTTP Server 2.2 Oracle Java SE JDK 7 Oracle Java SE JDK 8 EMC Documentum Content Server 4
FAPIS - Federal Awardee Performance	Oracle Java SE JDK 7 Oracle Java SE JDK 8	Oracle Java SE JDK 7 Oracle Java SE JDK 8

and Integrity Information System	Microsoft IIS 7 Apache Tomcat 7.0 Microsoft Windows Storage Server 2008 R2	Microsoft IIS 7 Apache Tomcat 7.0
FAV - FAS Accessibility Viewer	Oracle Database 11g JBoss 5.2 Eclipse Classic 4 Oracle Java SE JDK 7 Oracle Java SE JDK 8 Mozilla Foundation Javascript 1 Servlets 2.0 JavaServer Pages 2.0 W3C HTML 4 EMC Documentum Content Server 4	JBoss 5.2 Eclipse Classic 4 Oracle Java SE JDK 7 Oracle Java SE JDK 8 Mozilla Foundation Javascript 1 Servlets 2.0 JavaServer Pages 2.0 W3C HTML 4 EMC Documentum Content Server 4
Federal Vehicle Standard	MySQL AB MySQL 5 (Enterprise Edition) JBoss 5.2 Jinfonet JReport 13.1 W3C Cascading Style Sheets 2 Oracle Java SE JDK 7 Oracle Java SE JDK 8 Eclipse Classic 4	MySQL AB MySQL 5 (Enterprise Edition) JBoss 5.2 Jinfonet JReport 13.1 W3C Cascading Style Sheets 2 Oracle Java SE JDK 7 Oracle Java SE JDK 8 Eclipse Classic 4
FedFMS - Federal Fleet Management System	Unisys DMSII Unisys Programmer's Workbench 54 W3C Cascading Style Sheets 2 Adobe Dreamweaver 10 COBOL 85 Oracle Java SE JDK 7 Oracle Java SE JDK 8 W3C HTML 5 W3C Extensible Markup Language (XML) 1 ALGOL 68 W3C Web Services Description Language (WSDL) 2 Work Flow Language (WFL) Decision Support Inc URSA Major 11.1.x Mozilla Foundation Javascript 1 jQuery 2 WebPCM CANDE DBATools Cascading Style Sheets (CSS) COMS jQuery 1 JSON	Unisys DMSII Unisys Programmer's Workbench 54 W3C Cascading Style Sheets 2 Oracle Java SE JDK 7 Oracle Java SE JDK 8 W3C HTML 5 W3C Extensible Markup Language (XML) 1 ALGOL 68 W3C Web Services Description Language (WSDL) 2 Work Flow Language (WFL) Decision Support Inc URSA Major 11.1.x Mozilla Foundation Javascript 1 jQuery 2 WebPCM CANDE DBATools Cascading Style Sheets (CSS) COMS jQuery 1 JSON
Fleet Viewer	Oracle Database 11g JBoss 5.2 Apache HTTP Server 2.2 Oracle Java SE JDK 7	JBoss 5.2 Apache HTTP Server 2.2 Oracle Java SE JDK 7

	Oracle Java SE JDK 8 Red Hat Enterprise Linux 5 Documentum D2-Config 4.2	Oracle Java SE JDK 8 Red Hat Enterprise Linux 5 Documentum D2-Config 4.2
FMS - Fleet Management System	Unisys DMSII Unisys Programmer's Workbench 54 W3C Cascading Style Sheets 2 Unisys ClearPath ePortal Developer 5 Microsoft C# 4.0 COBOL 85 Oracle Java SE JDK 7 Oracle Java SE JDK 8 W3C HTML 5 W3C Extensible Markup Language (XML) 1 ALGOL 68 W3C Web Services Description Language (WSDL) 2 Work Flow Language (WFL) Decision Support Inc URSA Major 11.1.x Mozilla Foundation Javascript 1 Unisys MCP 16 JQuery 2 WebPCM ePortal Server CANDE DBATools Cascading Style Sheets (CSS) COMS JQuery 1 JSON	Unisys DMSII Unisys Programmer's Workbench 54 W3C Cascading Style Sheets 2 Unisys ClearPath ePortal Developer 5 Microsoft C# 4.0 Oracle Java SE JDK 7 Oracle Java SE JDK 8 W3C HTML 5 W3C Extensible Markup Language (XML) 1 ALGOL 68 W3C Web Services Description Language (WSDL) 2 Work Flow Language (WFL) Decision Support Inc URSA Major 11.1.x Mozilla Foundation Javascript 1 Unisys MCP 16 JQuery 2 WebPCM ePortal Server CANDE DBATools Cascading Style Sheets (CSS) COMS JQuery 1 JSON
FMS Europe - Fleet Management System Europe	Unisys DMSII Unisys Programmer's Workbench 54 Unisys ClearPath ePortal Developer 5 W3C Cascading Style Sheets 2 Microsoft C# 4.0 COBOL 85 Oracle Java SE JDK 7 Oracle Java SE JDK 8 W3C HTML 5 W3C Extensible Markup Language (XML) 1 ALGOL 68 W3C Web Services Description Language (WSDL) 2 Work Flow Language (WFL) Decision Support Inc URSA Major 11.1.x Unisys MCP 16 JQuery 2 WebPCM CANDE	Unisys DMSII Unisys Programmer's Workbench 54 Unisys ClearPath ePortal Developer 5 W3C Cascading Style Sheets 2 Microsoft C# 4.0 Oracle Java SE JDK 7 Oracle Java SE JDK 8 W3C HTML 5 W3C Extensible Markup Language (XML) 1 ALGOL 68 W3C Web Services Description Language (WSDL) 2 Work Flow Language (WFL) Decision Support Inc URSA Major 11.1.x

	DBATools Cascading Style Sheets (CSS) COMS jQuery 1 JSON	Unisys MCP 16 jQuery 2 WebPCM CANDE DBATools Cascading Style Sheets (CSS) COMS jQuery 1 JSON
FMVRS - Federal Motor Vehicle Registration System	Unisys DMSII Unisys Programmer's Workbench 54 W3C Cascading Style Sheets 2 Adobe Dreamweaver 10 COBOL 85 Oracle Java SE JDK 7 Oracle Java SE JDK 8 W3C HTML 5 W3C Extensible Markup Language (XML) 1 ALGOL 68 W3C Web Services Description Language (WSDL) 2 Work Flow Language (WFL) Decision Support Inc URSA Major 11.1.x Mozilla Foundation Javascript 1 Unisys MCP 16 jQuery 2 WebPCM CANDE DBATools Cascading Style Sheets (CSS) COMS jQuery 1 JSON	Unisys DMSII Unisys Programmer's Workbench 54 W3C Cascading Style Sheets 2 Oracle Java SE JDK 7 Oracle Java SE JDK 8 W3C HTML 5 W3C Extensible Markup Language (XML) 1 ALGOL 68 W3C Web Services Description Language (WSDL) 2 Work Flow Language (WFL) Decision Support Inc URSA Major 11.1.x Mozilla Foundation Javascript 1 Unisys MCP 16 jQuery 2 WebPCM CANDE DBATools Cascading Style Sheets (CSS) COMS jQuery 1 JSON
Foreign Gifts	Unisys DMSII Java COBOL 2002 jQuery 2 Oracle Java SE JDK 7 Oracle Java SE JDK 8 W3C HTML 5 W3C Extensible Markup Language (XML) 1 ALGOL 68 W3C Web Services Description Language (WSDL) 2 Work Flow Language (WFL) Decision Support Inc URSA Major 11.1.x Mozilla Foundation Javascript 1 WebPCM DBATools Cascading Style Sheets (CSS)	Unisys DMSII Java jQuery 2 Oracle Java SE JDK 7 Oracle Java SE JDK 8 W3C HTML 5 W3C Extensible Markup Language (XML) 1 ALGOL 68 W3C Web Services Description Language (WSDL) 2 Work Flow Language (WFL) Decision Support Inc URSA Major 11.1.x Mozilla Foundation Javascript 1

	COMS jQuery 1 JSON	WebPCM DBATools Cascading Style Sheets (CSS) COMS jQuery 1 JSON
Form 2553 Fleet Management	Salesforce Force.com Oracle APEX 4 Mozilla Foundation Javascript 1 jQuery 2 jQuery 1	Salesforce Force.com Oracle APEX 4 Mozilla Foundation Javascript 1 jQuery 2 jQuery 1
FPDS - Federal Procurement Data System	Oracle Java SE JDK 7 Oracle Java SE JDK 8 Red Hat Enterprise Linux 5 JBoss 5.2 Microsoft Windows Server 2012 VFMWARE VSPHERE Enterprise 5	Oracle Java SE JDK 7 Oracle Java SE JDK 8 Red Hat Enterprise Linux 5 JBoss 5.2 Microsoft Windows Server 2012 VFMWARE VSPHERE Enterprise 5
FSS-19 - Federal Supply Service 19 Portal	Apache HTTP Server 1 iPlanet Web Server 7 Microsoft Access XP (10) M-Tech Identity Management Suite 4 Oracle Java Enterprise Edition 5 Oracle JDeveloper 11 Oracle Solaris 11 Oracle Java SE JRE 7 Red Hat Enterprise Linux 5 SAP Sybase Enterprise Application Server 2.0 Sybase Enterprise Portal 6 Unisys DMSII Universal Report Specifying Application 9.0 COBOL 2002 Work Flow Language (WFL) Unisys MCP 13	TBD
FSS-19-FI - FSS-19 Finance	Apache HTTP Server 1 iPlanet Web Server 7 Microsoft Access XP (10) M-Tech Identity Management Suite 4 Oracle Java Enterprise Edition 5 Oracle JDeveloper 11 Oracle Solaris 11 Oracle Java SE JRE 7 Red Hat Enterprise Linux 5 SAP Sybase Enterprise Application Server 2.0 Sybase Enterprise Portal 6 Unisys DMSII Universal Report Specifying Application 9.0 COBOL 2002 Work Flow Language (WFL) Unisys MCP 13 Unisys Programmer's Workbench 54	TBD

	Unisys MCP 16 COBOL 85	
FSS-19-IM - FSS-19 Inventory Management	Unisys MCP 13 Work Flow Language (WFL) COBOL 2002 Universal Report Specifying Application 9.0 Unisys DMSII Sybase Enterprise Portal 6 SAP Sybase Enterprise Application Server 2.0 Red Hat Enterprise Linux 5 Oracle Java SE JRE 7 Oracle Solaris 11 Oracle JDeveloper 11 Oracle Java Enterprise Edition 5 M-Tech Identity Management Suite 4 Microsoft Access XP (10) iPlanet Web Server 7 Apache HTTP Server 1 Unisys Programmer's Workbench 54 Unisys MCP 16 COBOL 85	TBD
FSS-19-LM - FSS-19 Logistics Management	Apache HTTP Server 1 iPlanet Web Server 7 Microsoft Access XP (10) M-Tech Identity Management Suite 4 Oracle Java Enterprise Edition 5 Oracle JDeveloper 11 Oracle Solaris 11 Oracle Java SE JRE 7 Red Hat Enterprise Linux 5 SAP Sybase Enterprise Application Server 2.0 Sybase Enterprise Portal 6 Unisys DMSII Universal Report Specifying Application 9.0 COBOL 2002 Work Flow Language (WFL) Unisys MCP 13 Unisys Programmer's Workbench 54 Unisys MCP 16 COBOL 85	TBD
FSS-19-OP - FSS-19 Order Processing	Unisys DMSII COBOL 2002 Unisys MCP 13 Apache HTTP Server 1 iPlanet Web Server 7 M-Tech Identity Management Suite 4 Microsoft Access XP (10) Oracle Java Enterprise Edition 5 Oracle JDeveloper 11 Oracle Solaris 11 Oracle Java SE JRE 7 Red Hat Enterprise Linux 5 SAP Sybase Enterprise Application Server 2.0	TBD

	Sybase Enterprise Portal 6 Universal Report Specifying Application 9.0 Work Flow Language (WFL) Unisys Programmer's Workbench 54 Unisys MCP 16 COBOL 85	
FSS-19-PM - FSS-19 Production Management	Apache HTTP Server 1 iPlanet Web Server 7 JBoss ESB Microsoft Access XP (10) M-Tech Identity Management Suite 4 Oracle Java Enterprise Edition 5 Oracle JDeveloper 11 Oracle Solaris 11 Oracle Java SE JRE 7 Red Hat Enterprise Linux 5 SAP Sybase Enterprise Application Server 2.0 Sybase Enterprise Portal 6 Unisys DMSII Universal Report Specifying Application 9.0 COBOL 2002 Work Flow Language (WFL) Unisys MCP 13 Unisys Programmer's Workbench 54 Unisys MCP 16 COBOL 85	TBD
FSS-19-PR - FSS-19 Procurement	Apache HTTP Server 1 iPlanet Web Server 7 Microsoft Access XP (10) M-Tech Identity Management Suite 4 Oracle Java Enterprise Edition 5 Oracle JDeveloper 11 Oracle Solaris 11 Oracle Java SE JRE 7 Red Hat Enterprise Linux 5 SAP Sybase Enterprise Application Server 2.0 Sybase Enterprise Portal 6 Unisys DMSII Universal Report Specifying Application 9.0 COBOL 2002 Work Flow Language (WFL) Unisys MCP 13 Unisys Programmer's Workbench 54 Unisys MCP 16 COBOL 85	TBD
FSS-19-QC - FSS-19 Quality Control	Apache HTTP Server 1 iPlanet Web Server 7 Microsoft Access XP (10) M-Tech Identity Management Suite 4 Oracle Java Enterprise Edition 5 Oracle JDeveloper 11 Oracle Solaris 11 Oracle Java SE JRE 7	TBD

	Red Hat Enterprise Linux 5 SAP Sybase Enterprise Application Server 2.0 Sybase Enterprise Portal 6 Unisys DMSII Universal Report Specifying Application 9.0 COBOL 2002 Work Flow Language (WFL) Unisys MCP 13 Unisys Programmer's Workbench 54 Unisys MCP 16 COBOL 85	
FSS-19-SD - FSS-19 Supply Distribution	Apache HTTP Server 1 iPlanet Web Server 7 Microsoft Access XP (10) M-Tech Identity Management Suite 4 Oracle Java Enterprise Edition 5 Oracle JDeveloper 11 Oracle Solaris 11 Oracle Java SE JRE 7 Red Hat Enterprise Linux 5 SAP Sybase Enterprise Application Server 2.0 Sybase Enterprise Portal 6 Unisys DMSII Universal Report Specifying Application 9.0 COBOL 2002 Work Flow Language (WFL) Unisys MCP 13 Unisys Programmer's Workbench 54 Unisys MCP 16 COBOL 85	TBD
FSSI DDS3 - Federal Strategic Sourcing Initiative Domestic Delivery Services	MySQL AB MySQL 5 (Enterprise Edition) JBoss 5.2 Apache Tomcat 6.0 Microsoft Windows Server 2008 R2 Enterprise Oracle Java SE JDK 7 Oracle Java SE JDK 8 Eclipse Classic 4 Microsoft Windows Server 2008 Datacenter	TBD
GECO - GSA Enhanced Checkout	Microsoft C# 4.0 Microsoft SQL Server 2008 Microsoft Windows Server 2008 R2 Enterprise W3C HTML 5 Oracle Java SE JDK 7 Oracle Java SE JDK 8 Microsoft Visual Studio 2013 W3C XSLT Microsoft Windows Server 2008 Datacenter	TBD
Global Supply Virtual Store	SAP BusinessObjects XI 4 Java Red Hat Enterprise Linux 5 Apache HTTP Server 2.2 Sybase Adaptive Server Enterprise 15 ISO/IEC SQL 2008	TBD

	W3C HTML 5 Oracle Solaris 11	
GovSales - Government Sales	Unisys DMSII Java COBOL 2002 Microsoft Visual Studio 2005 Work Flow Language (WFL) COBOL 85 Oracle Java SE JDK 7 Oracle Java SE JDK 8 W3C HTML 5 W3C Extensible Markup Language (XML) 1 ALGOL 68 W3C Web Services Description Language (WSDL) 2 Decision Support Inc URSA Major 11.1.x Mozilla Foundation Javascript 1 jQuery 2 WebPCM DBATools Cascading Style Sheets (CSS) COMS jQuery 1 JSON	TBD
GSA Advantage Portal	Apache Tomcat 7.0 iPlanet Web Server 7 Microsoft Access XP (10) Microsoft Windows 2003 Server R2 Enterprise Microsoft Windows 2008 Terminal Server (6.1) M-Tech Identity Management Suite 4 Oracle Database 11g Oracle Java Enterprise Edition 5 Oracle JDeveloper 11 Oracle Solaris 11 Oracle Java SE JRE 7 Java Red Hat Enterprise Linux 5 Red Hat Enterprise Linux 6 SAP Sybase Enterprise Application Server 2.0 Sybase Adaptive Server Enterprise 15 Sybase Enterprise Portal 6 Sybase Powerbuilder 12 SAP BusinessObjects XI 4 Apache HTTP Server 2.2 ISO/IEC SQL 2008 W3C HTML 5 Red Hat Enterprise Linux 7.1	TBD
GSA Advantage Virtual Store	SAP BusinessObjects XI 4 Java Red Hat Enterprise Linux 5 Apache HTTP Server 2.2 Sybase Adaptive Server Enterprise 15 ISO/IEC SQL 2008	TBD

	W3C HTML 5 Oracle Solaris 11	
GSA Conexus	Oracle Java SE JDK 7 Oracle Java SE JDK 8 Oracle Java Enterprise Edition 6 IntelliJ 14.0	TBD
GSA Fleet Drive-Thru	Unisys DMSII Unisys Programmer's Workbench 54 W3C Cascading Style Sheets 2 Adobe Dreamweaver 10 COBOL 85 Oracle Java SE JDK 7 Oracle Java SE JDK 8 W3C HTML 5 W3C Extensible Markup Language (XML) 1 ALGOL 68 W3C Web Services Description Language (WSDL) 2 Work Flow Language (WFL) Decision Support Inc URSA Major 11.1.x Mozilla Foundation Javascript 1 jQuery 2 WebPCM CANDE DBATools Cascading Style Sheets (CSS) COMS jQuery 1 JSON	TBD
GSA SmartPay Data Warehouse	SAP BusinessObjects XI 4 Tableau Desktop 8.3 JBoss 5.2 Apache Tomcat 6.0 Oracle Java SE JDK 7 Oracle Java SE JDK 8 Oracle Solaris 10 Sybase IQ 16.0 Sybase IQ 15.0 Microsoft Windows Server 2008 R2 Enterprise Pentaho Data Integration (PDI) 6.0 Microsoft Windows Server 2008 Datacenter	TBD
GSAAuctions - FAS Personal Property	Unisys DMSII Decision Support Inc URSA Major 11.1.x COBOL 85 Oracle Java SE JDK 7 Oracle Java SE JDK 8 W3C HTML 5 W3C Extensible Markup Language (XML) 1 ALGOL 68 W3C Web Services Description Language (WSDL) 2 Work Flow Language (WFL) Mozilla Foundation Javascript 1	TBD

	Jinfony JReport 13.1 JQuery 2 WebPCM DBATools Cascading Style Sheets (CSS) COMS JQuery 1 JSON	
GSAAuctions - PBS Real Estate	COBOL 85 Oracle Java SE JDK 7 Oracle Java SE JDK 8 W3C HTML 5 W3C Extensible Markup Language (XML) 1 ALGOL 68 W3C Web Services Description Language (WSDL) 2 Work Flow Language (WFL) Decision Support Inc URSA Major 11.1.x Mozilla Foundation Javascript 1 Unisys DMSII Jinfony JReport 13.1 JQuery 2 WebPCM DBATools Cascading Style Sheets (CSS) COMS JQuery 1 JSON	TBD
GSAXcess	Unisys DMSII COBOL 85 Oracle Java SE JDK 7 Oracle Java SE JDK 8 W3C HTML 5 W3C Extensible Markup Language (XML) 1 ALGOL 68 W3C Web Services Description Language (WSDL) 2 Work Flow Language (WFL) Decision Support Inc URSA Major 11.1.x Mozilla Foundation Javascript 1 JQuery 2 WebPCM DBATools Cascading Style Sheets (CSS) COMS JQuery 1 JSON	TBD
GSS Personal Properties	Oracle Database 11g JBoss 5.2 Apache HTTP Server 2.2 Oracle Java SE JDK 7 Oracle Java SE JDK 8 EMC Documentum Content Server 4	TBD

ITOMS - Integrated Task Order Management System	Apache HTTP Server 1 IBM Lotus Domino 8 Microsoft Windows 2003 Server R2 Enterprise Oracle Database 10g Oracle Database 11g Red Hat Enterprise Linux 4 Red Hat Enterprise Linux 5	TBD
ITSS - IT Solutions Shop	Apache HTTP Server 1 IBM Lotus Domino 8 Microsoft Windows 2003 Server R2 Enterprise Oracle Database 10g Oracle Database 11g Red Hat Enterprise Linux 4 Red Hat Enterprise Linux 5	TBD
Mass Mods - Mass Modifications	Unisys DMSII JBoss jBPM Apache HTTP Server 2.2 Oracle Java Enterprise Edition 7 Mozilla Foundation Javascript 1 Red Hat Enterprise Linux 6 The Open Group Unix 03 Red Hat Enterprise Linux 7.1	TBD
MySales	Unisys DMSII JQuery 2 COBOL 85 Oracle Java SE JDK 7 Oracle Java SE JDK 8 W3C HTML 5 W3C Extensible Markup Language (XML) 1 ALGOL 68 W3C Web Services Description Language (WSDL) 2 Work Flow Language (WFL) Decision Support Inc URSA Major 11.1.x Mozilla Foundation Javascript 1 WebPCM DBATools Cascading Style Sheets (CSS) COMS JQuery 1 JSON	TBD
NASA Space Artifacts	Unisys DMSII COBOL 85 Oracle Java SE JDK 7 Oracle Java SE JDK 8 W3C HTML 5 W3C Extensible Markup Language (XML) 1 ALGOL 68 W3C Web Services Description Language (WSDL) 2 Work Flow Language (WFL) Decision Support Inc URSA Major 11.1.x Mozilla Foundation Javascript 1	TBD

	JQuery 2 WebPCM DBATools Cascading Style Sheets (CSS) COMS JQuery 1 JSON	
NCAL - National Cataloging Action Log	Oracle Java SE JDK 7 Oracle Java SE JDK 8 Sybase Adaptive Server Enterprise 15 Red Hat Enterprise Linux 5 Unisys DMSII Microsoft Windows 7 (6.0) JBoss 5.2 Red Hat Enterprise Linux 6 Red Hat Enterprise Linux 7.1	TBD
NCSC Manage Quality Review	Salesforce Force.com Oracle APEX 4	TBD
NSAP - National Strategy Account Planning	Oracle APEX 4 Salesforce Force.com	TBD
OMIS - Online Management Information System	Microsoft Windows 2003 Server R2 Enterprise Oracle Database 10g Oracle Database 11g Red Hat Enterprise Linux 4 Red Hat Enterprise Linux 5	TBD
ORS - Offer Registration System	Unisys DMSII Sybase Adaptive Server Enterprise 15 Oracle Java Enterprise Edition 7 JBoss jBPM Apache HTTP Server 2.2 Microsoft Windows 7 (6.0) Red Hat Enterprise Linux 6 Red Hat Enterprise Linux 7.1	TBD
Password Approval and Assignment Application	Java Red Hat Enterprise Linux 5 Apache HTTP Server 2.2 Sybase Adaptive Server Enterprise 15 ISO/IEC SQL 2008 W3C HTML 5 Oracle Solaris 11	TBD
PO Portal - Purchase Order Portal	Java Red Hat Enterprise Linux 5 Apache HTTP Server 2.2 Sybase Adaptive Server Enterprise 15 ISO/IEC SQL 2008 W3C HTML 5 Oracle Solaris 11	TBD
PPIRS - Past Performance Information Retrieval System	Apache HTTP Server 2.2 Apache Tomcat 7.0 Oracle Database 11g Microsoft IIS 7 Microsoft Windows Server 2008 Datacenter	TBD

	OpenSSL 1.0H IPSwitchft MOVEit Central Enterprise 8 IPSwitchft MOVEit DMZ Enterprise 7.5	
RAP - Ride-Along Program	Salesforce Force.com Clicktools Oracle APEX 4 Mozilla Foundation Javascript 1 JQuery 2 JQuery 1	TBD
Reverse Auction (Commodity Buy)	Jinfonet JReport 13.1 Unisys DMSII Unisys Programmer's Workbench 54 COBOL 85 Oracle Java SE JDK 7 Oracle Java SE JDK 8 W3C HTML 5 W3C Extensible Markup Language (XML) 1 W3C Web Services Description Language (WSDL) 2 Work Flow Language (WFL) Decision Support Inc URSA Major 11.1.x Mozilla Foundation Javascript 1 JQuery 2 WebPCM DBATools Cascading Style Sheets (CSS) COMS JQuery 1 JSON	TBD
ROADS - Requisitioning, Ordering and Documentation System	MySQL AB MySQL 5 (Enterprise Edition) JBoss 5.2 Jinfonet JReport 13.1 W3C Cascading Style Sheets 2 Oracle Java SE JDK 7 Oracle Java SE JDK 8 Eclipse Classic 4	TBD
SAM - System for Award Management	Oracle Java SE JDK 7 Oracle Java SE JDK 8 Dell Toad DBA Suite for Sybase v2.1 VFMWARE VSPHERE Enterprise 4 Microsoft Visual Basic .NET 2005 VFMWARE VSPHERE Enterprise 5 Oracle Database 11g Red Hat Enterprise Linux 6 Linux 2 JBoss 5.2 Apache HTTP Server 1 IBM Rational ClearCase 8 IBM Websphere Portal 6	TBD
SASy - Sales Automation System	Unisys DMSII COBOL 85 Oracle Java SE JDK 7 Oracle Java SE JDK 8	TBD

	W3C HTML 5 W3C Extensible Markup Language (XML) 1 W3C Web Services Description Language (WSDL) 2 Jinfony JReport 13.1 JQuery 2 WebPCM DBATools Cascading Style Sheets (CSS) COMS JQuery 1 JSON	
STR - Short Term Rental	Jinfony JReport 13.1 Unisys DMSII Unisys Programmer's Workbench 54 W3C Cascading Style Sheets 2 Adobe Dreamweaver 10 COBOL 85 Oracle Java SE JDK 7 Oracle Java SE JDK 8 W3C HTML 5 W3C Extensible Markup Language (XML) 1 ALGOL 68 W3C Web Services Description Language (WSDL) 2 Work Flow Language (WFL) Decision Support Inc URSA Major 11.1.x Mozilla Foundation Javascript 1 Unisys MCP 16 JQuery 2 WebPCM CANDE DBATools Cascading Style Sheets (CSS) COMS JQuery 1 JSON	TBD
SWS - Solicitation Writing System	Sybase Adaptive Server Enterprise 15 JBoss jBPM Apache HTTP Server 2.2 JBoss 5.2 Microsoft Windows 7 (6.0) Mozilla Foundation Javascript 1 Red Hat Enterprise Linux 5 Eclipse Classic 4 Oracle Java SE JDK 7	TBD
TARPS - Transportation Accounts Receivable and Payable System	Microsoft .NET Framework 4.0 Microsoft Visual Studio 2005 Microsoft Windows Server 2003 Standard Unisys DMSII Oracle Java SE JDK 7 Oracle Java SE JDK 8 W3C HTML 5	TBD

	Unisys ClearPath ePortal Developer 5 Universal Report Specifying Application 9.0 Mozilla Foundation Javascript 1 Unisys MCP 13 Microsoft Windows 2000 Server Standard Microsoft .NET Framework 4.5 JQuery 2 JQuery 1	
TDR - Transactional Data Repository	Oracle JDeveloper 11 Java JavaScript Oracle Java SE JDK 7 Oracle Java SE JDK 8 Tableau Desktop 9 Mozilla Foundation Javascript 1 Red Hat Enterprise Linux 6 JQuery 2 Oracle Java Enterprise Edition 8 MongoDB 3.0.6 JQuery 1 Red Hat Enterprise Linux 7.1 Apache HTTP Server 2.2 Eclipse Classic 4 JBoss ESB JBoss 5.2	TBD
TIM - Telecom Invoice Management	Microsoft IIS 7 Microsoft .NET Framework 4.5 SAP BusinessObjects XI 4 Microsoft Visual Basic .NET 2010 Oracle Database 11g	TBD
TMSS - Transportation Management Services Solution	Unisys DMSII Unisys Programmer's Workbench 54 Adobe Dreamweaver 10 COBOL 85 Oracle Java SE JDK 7 Oracle Java SE JDK 8 W3C HTML 5 W3C Extensible Markup Language (XML) 1 ALGOL 68 W3C Web Services Description Language (WSDL) 2 Work Flow Language (WFL) Decision Support Inc URSA Major 11.1.x Mozilla Foundation Javascript 1 JQuery 2 Unisys MCP 16 WebPCM W3C HTML 4 CANDE DBATools Cascading Style Sheets (CSS) COMS	TBD

	JQuery 1 JSON	
TOPS - Telecommunications Ordering and Pricing System	Oracle Database 11g Oracle Forms and Report Developer 11g Oracle HTTP Server 11g Oracle WebLogic Server 9 Oracle Developer Suite 10g COBOL 2002 W3C HTML 5 Microsoft SQL Server 2010 Oracle PL/SQL The Open Group Unix 03 Oracle Solaris 11	TBD
TOS - Tracking and Ordering System	Microsoft Windows 2003 Server R2 Enterprise Oracle Database 10g Oracle Database 11g Red Hat Enterprise Linux 4 Red Hat Enterprise Linux 5	TBD
VANS - GSA Export Cargo Shipment Instructions System	Unisys DMSII JBoss jBPM Apache HTTP Server 2.2 Oracle Java Enterprise Edition 7 W3C HTML 5 Red Hat Enterprise Linux 6 Red Hat Enterprise Linux 7.1	TBD
VFE - Vehicle Fleet Exchange	Unisys DMSII Unisys Programmer's Workbench 54 Adobe Dreamweaver 10 COBOL 85 Oracle Java SE JDK 7 Oracle Java SE JDK 8 W3C HTML 5 W3C Extensible Markup Language (XML) 1 ALGOL 68 W3C Web Services Description Language (WSDL) 2 Work Flow Language (WFL) Decision Support Inc URSA Major 11.1.x Mozilla Foundation Javascript 1 Unisys MCP 16 jQuery 2 WebPCM CANDE DBATools Cascading Style Sheets (CSS) COMS jQuery 1 JSON	TBD
VISION	Salesforce Force.com Oracle APEX 4	TBD
WebARM - Web Automated Remarketing Module	Unisys DMSII JBoss 5.2 Eclipse Classic 4	TBD

	Oracle Java SE JDK 7 Oracle Java SE JDK 8 Spring Framework 4 Unisys ClearPath ePortal Developer 5 Apache Tomcat 2.0 JavaServer Pages 2.0 Red Hat Hibernate ORM 3	
WMS Viewer - Warehouse Management System Viewer	Sybase IQ 16.0 JBoss 5.2 Eclipse Classic 4 Oracle Java SE JDK 7 Oracle Java SE JDK 8	TBD
GAMS - GSA Access Management System	Oracle Access Manager AccessGate 11g Oracle Access Manager WebGate 11g Oracle Access Manager with Oracle Secure Token Service (STS) 11g Oracle Directory Services Manager 11g Oracle Enterprise Single Sign-On 11g Oracle Identity Federation 11g Oracle Identity Manager 11g Oracle Internet Directory 11g Oracle OpenSSO Enterprise Policy Agent 3.0 Oracle Virtual Directory 11g Oracle Directory Server Enterprise Edition 11g	TBD
Accounts Payable	BIRT v4.0 Oracle Database 11g Apache HTTP Server 2.0 Microsoft Visual Studio 2010 ANSI/ISO C++ 2011 JavaScript PERL 5 IBM AIX 7 Red Hat Enterprise Linux 6 Red Hat Enterprise Linux 5	TBD
Accounts Receivable/Billing	BIRT v4.0 Oracle Database 11g Apache HTTP Server 2.0 Microsoft Visual Studio 2010 ANSI/ISO C++ 2011 JavaScript PERL 5 IBM AIX 7 Red Hat Enterprise Linux 6 Red Hat Enterprise Linux 5	TBD
ARCS - Accounts Receivable Claim System	Oracle Application Server 11g Oracle Database 11g Red Hat Enterprise Linux 6 Java JavaScript Oracle JDeveloper 11	TBD
Automated Disbursements	BIRT v4.0 Oracle Database 11g Apache HTTP Server 2.0	TBD

	Microsoft Visual Studio 2010 ANSI/ISO C++ 2011 JavaScript PERL 5 IBM AIX 7 Red Hat Enterprise Linux 6 Red Hat Enterprise Linux 5	
BART - Billed Accounts Receivable Tracking	Microsoft Windows 2003 Server R2 Enterprise Oracle Database 11g Microsoft .NET Framework 3.5	TBD
BASICS - BEC Assurance Statement and Internal Control System	Microsoft Windows 2003 Server R2 Enterprise Oracle Database 11g Microsoft IIS 6 Microsoft Visual Studio 2008	TBD
BillView	Oracle Database 12c (Possibly others, the interviews are not yet complete)	TBD
Budget Execution	BIRT v4.0 Oracle Database 11g Apache HTTP Server 2.0 Microsoft Visual Studio 2010 ANSI/ISO C++ 2011 JavaScript PERL 5 IBM AIX 7 Red Hat Enterprise Linux 6 Red Hat Enterprise Linux 5	TBD
BULKLOAD	Oracle Application Server 11g JavaScript Apache HTTP Server 2.0 Red Hat Enterprise Linux 6 Quest Software Toad 11 Oracle Forms and Report Developer 11g	TBD
CCRC - Central Contractor Registration Connector	BIRT v4.0 Oracle Database 11g Apache HTTP Server 2.0 Microsoft Visual Studio 2010 ANSI/ISO C++ 2011 JavaScript PERL 5 IBM AIX 7 Red Hat Enterprise Linux 6 Red Hat Enterprise Linux 5	TBD
Child Care Subsidy	Drupal JBoss ESB Oracle Application Server 11g Oracle Forms and Report Developer 11g	TBD
Cost Allocation	BIRT v4.0 Oracle Database 11g Apache HTTP Server 2.0 Microsoft Visual Studio 2010 ANSI/ISO C++ 2011 JavaScript PERL 5	TBD

	IBM AIX 7 Red Hat Enterprise Linux 6 Red Hat Enterprise Linux 5	
Credit Card	BIRT v4.0 Oracle Database 11g Apache HTTP Server 2.0 Microsoft Visual Studio 2010 ANSI/ISO C++ 2011 JavaScript PERL 5 IBM AIX 7 Red Hat Enterprise Linux 6 Red Hat Enterprise Linux 5	TBD
DoDAAC Search - DOD Activity Address Code Search	Oracle Database 12c Microsoft Visual Studio 2013 Microsoft IIS 7 Microsoft Windows Server 2008 R2 Enterprise	TBD
External Reports	BIRT v4.0 Oracle Database 11g Apache HTTP Server 2.0 Microsoft Visual Studio 2010 ANSI/ISO C++ 2011 JavaScript PERL 5 IBM AIX 7 Red Hat Enterprise Linux 6 Red Hat Enterprise Linux 5	TBD
FEDPAY - Federal Supply Service Payment System (Govt Vendors)	Microsoft Windows 2003 Server R2 Enterprise Oracle Application Server 11g	TBD
FEDPAY - Federal Supply Service Payment System (GSA Users)	Microsoft Windows 2003 Server R2 Enterprise Oracle Application Server 11g	TBD
Fixed Assets	BIRT v4.0 Oracle Database 11g Apache HTTP Server 2.0 Microsoft Visual Studio 2010 ANSI/ISO C++ 2011 JavaScript PERL 5 IBM AIX 7 Red Hat Enterprise Linux 6 Red Hat Enterprise Linux 5	TBD
FMIS - Financial Management Information System	Microsoft Windows 2003 Server R2 Enterprise Oracle Database 11g	TBD
FODDCSC - Financial Operations & Disbursements Division Customer Supply Center	Oracle Application Server 11g Oracle Forms and Report Developer 11g JavaScript Apache HTTP Server 2.2 Quest Software Toad 11	TBD

	Red Hat Enterprise Linux 6 Oracle HTTP Server 11g	
FTS - Expense Accruals	Microsoft .NET Framework 3.5 Oracle Database 12c Microsoft Visual Studio 2013 Microsoft IIS 7	TBD
General Ledger	BIRT v4.0 Oracle Database 11g Apache HTTP Server 2.0 Microsoft Visual Studio 2010 ANSI/ISO C++ 2011 JavaScript PERL 5 IBM AIX 7 Red Hat Enterprise Linux 6 Red Hat Enterprise Linux 5	TBD
GSA Financial Management Data Collection	Oracle Database 12c (Possibly others, the interviews are not yet complete)	TBD
Lease Accounting	BIRT v4.0 Oracle Database 11g Apache HTTP Server 2.0 Microsoft Visual Studio 2010 ANSI/ISO C++ 2011 JavaScript PERL 5 IBM AIX 7 Red Hat Enterprise Linux 6 Red Hat Enterprise Linux 5	TBD
LPM - Labor Projection Model	Oracle Database 11g Oracle BI Beans 11g Oracle Application Server 10g Oracle HTTP Server 11g Oracle PL/SQL IBM AIX 7 Apache HTTP Server 2.2 Red Hat Enterprise Linux 6	TBD
PAR - Payroll Accounting and Reporting	Oracle Database 11g	TBD
Planning	BIRT v4.0 Oracle Database 11g Apache HTTP Server 2.0 Microsoft Visual Studio 2010 ANSI/ISO C++ 2011 JavaScript PERL 5 IBM AIX 7 Red Hat Enterprise Linux 6 Red Hat Enterprise Linux 5	TBD
POLDR - Pegasys Online Disbursement Review	Oracle Database 11g Microsoft Windows 2003 Server R2 Enterprise Microsoft .NET Framework 3.5	TBD

Purchasing	BIRT v4.0 Oracle Database 11g Apache HTTP Server 2.0 Microsoft Visual Studio 2010 ANSI/ISO C++ 2011 JavaScript PERL 5 IBM AIX 7 Red Hat Enterprise Linux 6 Red Hat Enterprise Linux 5	TBD
Recon - Nationwide Trial Balance (NWTB)	Oracle Application Server 10g Oracle HTTP Server 11g Oracle Database 11g Apache HTTP Server 2.2 IBM AIX 7 Oracle Forms and Report Developer 11g Oracle PL/SQL JavaScript Red Hat Enterprise Linux 6 Quest Software Toad 11	TBD
Security	BIRT v4.0 Oracle Database 11g Apache HTTP Server 2.0 Microsoft Visual Studio 2010 ANSI/ISO C++ 2011 JavaScript PERL 5 IBM AIX 7 Red Hat Enterprise Linux 6 Red Hat Enterprise Linux 5	TBD
SIFT - Schedules Industrial Funding Transactions	Oracle Database 11g Release 2 Client	TBD
TSM - Travel Systems Management	Oracle Database 11g Oracle Application Server 11g Quest Software Toad 11 Red Hat Enterprise Linux 6 IBM AIX 7 Oracle Forms and Report Developer 11g Apache HTTP Server 2.2	TBD
USRDBRUN	Oracle Database 11g Release 2 Client VisualCron 5 VisualCron 7 Citrix XenAPP 6.5 for 2008 R2	TBD
VCSS - Vendor Customer Self Service	BIRT v4.0 Oracle Database 11g Apache HTTP Server 2.0 Microsoft Visual Studio 2010 ANSI/ISO C++ 2011 JavaScript PERL 5 IBM AIX 7	TBD

	Red Hat Enterprise Linux 6 Red Hat Enterprise Linux 5	
VITAP	Oracle Database 12c (Possibly others, the interviews are not yet complete)	TBD
Web Vendor	Oracle Database 12c (Possibly others, the interviews are not yet complete)	TBD
WEBBILL - Web Billings	Oracle Application Server 11g Oracle HTTP Server 11g Oracle Database 11g Apache HTTP Server 2.2 IBM AIX 7 Oracle Forms and Report Developer 11g Oracle PL/SQL Red Hat Enterprise Linux 6 Quest Software Toad 11 JavaScript	TBD
eCPIC - Electronic Capital Planning and Investment Control	Microsoft Windows 2003 Server R2 Enterprise Microsoft IIS 7 Microsoft .NET Framework 4.0 Oracle Database 11g	TBD
FRPP - Federal Real Property Profile	Microsoft IIS 6 Microsoft Visual Studio 2005 Microsoft Windows 2003 Server R2 Enterprise Oracle Database 11g Oracle DataProvider for .NET 11g	TBD
ROCIS - RSIC/OIRA Consolidated Information System	Apache HTTP Server 1 Apache Tomcat 7.0 Oracle Application Server 10g Oracle Database 11g Oracle JDeveloper 11 Oracle Solaris 11 Oracle Java SE JRE 7 SAP Crystal Reports 14	TBD
CHRIS - Comprehensive Human Resources Integrated System Portal	Oracle Federal HR	TBD
NSA - National Staffing Application	Microsoft Access 2010 (14) Oracle Application Server 11g	TBD
National Alert and Accountability System	Oracle Solaris 11	TBD
ABP - Asset Business Plan	Microsoft Windows Server 2012 Microsoft .NET Framework 3.0 Microsoft IIS 7 Oracle Database 11g	TBD
ADS - Appraisal Data System	Microsoft Windows Server 2008 R2 Enterprise Oracle Database 11g	TBD
BITS - Border Information Tracking System	Oracle Portal 11g Oracle Database 11g	TBD

BPP - Building Preservation Plan	Microsoft Windows Server 2008 Standard Edition Oracle Database 11g	TBD
CourtsWeb	Oracle Application Server 11g Oracle Database 11g Oracle Solaris 11 Java 2 5.0	TBD
CPA - Capital Projects Application	Microsoft IIS 6 Oracle Database 11g	TBD
CTLMT - Compliance Tracking Lease Management Tool	Appian BPM Suite Oracle Database 11g Release 2 Client	TBD
Customer Contact Database	Microsoft Windows 2000 Server Standard Oracle Database 11g	TBD
EASi - Electronic Acquisition System Integration	Appian BPM Suite Oracle Database 11g	TBD
EDMS - Electronic Document Management System	EMC Documentum 6 Microsoft .NET Framework 4.0 Microsoft IIS 7 Microsoft Windows 2003 Server R2 Enterprise Microsoft Windows XP SP3 Oracle Database 11g	TBD
Emergency Operations Center (a.k.a. Hurricane Crisis Management)	Microsoft Windows Server 2003 Standard Oracle Database 11g	TBD
EOP CMMS - Computerized Maintenance Management System	Microsoft Windows Server 2003 Standard Oracle Database 11g	TBD
eSMART - Electronic Spatial Management and Reporting Tool	Autodesk MapGuide Viewer 6 Oracle Database 11g Microsoft Windows Server 2008 R2 Standard Autodesk 3DS Max Design 2015 Autodesk AutoCAD 2015 Autodesk AutoCAD Civil 3D 2015 Autodesk AutoCAD Map 3D 2015	TBD
Extensis Portfolio	Microsoft Windows Server 2003 Standard Oracle Database 11g	TBD
G-REX - GSA Real Estate Exchange	Appian BPM Suite Oracle Database 11g	TBD
gBUILD - Recovery Act High Performing Green Building Database	Salesforce Force.com Oracle APEX 4	TBD
GISIOLP- Geospatial Information Service Inventory of Owned and Leased Properties	Microsoft SQL Server 2008 Oracle Application Server 10g Microsoft Windows Server 2008 R2 Enterprise Microsoft IIS 7	TBD

GSA PBS Office of Child Care Enrollment Figure Survey Website	Microsoft IIS 6 Microsoft Windows Server 2003 Standard Oracle Database 11g	TBD
GSA PBS Region 2 Lease Administration Website	Microsoft IIS 6 Microsoft Windows Server 2003 Standard Oracle Database 11g	TBD
GSALink	IBM Tririga module(s) Microsoft Windows Server 2008 R2 Enterprise Oracle Database 11g Niagara Workbench AX	TBD
IRIS - Inventory Reporting Information System	Apache HTTP Server 1 Oracle Application Server 10g Oracle Java SE JRE 6 Oracle Solaris 11 Oracle Database 11g	TBD
LA Team File Management Database	Microsoft Windows 2000 Server Standard Oracle Database 11g	TBD
Maximo	Microsoft Windows Server 2003 Standard Oracle Database 11g	TBD
OA Billing - Occupancy Agreement Billing	Oracle Solaris 11 Microsoft Windows Server 2008 R2 Standard Oracle Database 11g Oracle Application Server 11g	TBD
OA Tool - Occupancy Agreement Tool	Apache HTTP Server 1 Oracle Database 11g Oracle Solaris 11 Oracle WebLogic Server 10.3.4.0 Oracle Java Enterprise Edition 6	TBD
P3 - Consolidated BA 54 application	Microsoft IIS 6 Microsoft Windows Server 2003 Standard Oracle Database 11g	TBD
Parking Database	Microsoft Windows Server 2003 Standard Oracle Database 11g	TBD
PBS Portal	Apache HTTP Server 1 Apache Tomcat 7.0 Oracle Application Server 10g Oracle Database 11g Oracle Java Enterprise Edition 5 Oracle JDeveloper 11 Oracle Portal 11g Oracle Solaris 11 Oracle Java SE JRE 6 Oracle Java SE JRE 7	TBD
PCS/WebBER - Physical Condition Survey/ Web Building Evaluation Report	Apache Tomcat 6.0 Oracle Database 11g Java 2 5.0 Microsoft Windows Server 2008 R2 Standard	TBD
RBMT - Rent Bill Management Tool	Oracle WebLogic Server 10.3.4.0 Oracle Database 11g JBoss jBPM	TBD

Rent Estimate	Oracle Application Server 11g Oracle Database 11g Oracle WebLogic Server 10.3.4.0 Oracle Java Enterprise Edition 5 Oracle OC4J 10 Oracle Solaris 11	TBD
RETA - Reimbursable Work Authorization Entry and Tracking Application	Oracle Database 11g Oracle DataProvider for .NET 11g Microsoft .NET Framework 4.5 Microsoft Windows Server 2012 Microsoft IIS 7	TBD
REXUS - Real Estate Across the US	Apache HTTP Server 1 M-Tech Identity Management Suite 4 Oracle Application Server 10g Oracle Database 11g Oracle DataProvider for .NET 11g Oracle WebLogic Server 10.3.4.0 Oracle JDeveloper 11 Oracle Portal 11g Oracle Solaris 11 Oracle Tuxedo 11g	TBD
ROW - Rent on the Web	Oracle Database 11g Microsoft Windows Server 2008 R2 Standard	TBD
TMS - The Museum System	Microsoft .NET Framework 3.0 Java 2 5.0 Microsoft Windows Server 2008 R2 Standard Oracle Database 11g Apache HTTP Server 2.2	TBD
UIMS - Universal Identity Management System	Oracle Application Server 10g Oracle Database 11g Oracle Portal 11g Oracle Solaris 11	TBD

RDBMS to NoSQL

Use an RDBMS when you need/have...	Use NoSQL when you need/have...
Centralized applications (e.g. ERP)	Decentralized applications (e.g. Web, mobile and IOT)
Moderate to high availability	Continuous availability; no downtime
Moderate velocity data	High velocity data (devices, sensors, etc.)
Data coming in from one/few locations	Data coming in from many locations
Primarily structured data	Structured, with semi/unstructured
Complex/nested transactions	Simple transactions
Primary concern is scaling reads	Concern is to scale both writes and reads
Philosophy of scaling up for more users/data	Philosophy of scaling out for more users/data

To maintain moderate data volumes with purge	To maintain high data volumes; retain forever
--	---

NoSQL encompasses a wide variety of different database technologies that were developed in response to the demands presented in modern applications:

- Developers are working with applications that create massive volumes of new, rapidly changing data types - structured, semi-structured, unstructured and polymorphic data.
- Applications that once served a finite audience are now delivered as services that must be always-on, accessible from many different devices and scaled globally to millions of users.
- Organizations are now turning to scale-out architectures using open source software, commodity servers and cloud computing instead of large monolithic servers and storage infrastructure.

Relational databases were not designed to cope with the scale and agility challenges that face modern applications, nor were they built to take advantage of the commodity storage and processing power available today.

NoSQL Database Types

- **Document databases** pair each key with a complex data structure known as a document. Documents can contain many different key-value pairs, or key-array pairs, or even nested documents.
- **Graph stores** are used to store information about networks of data, such as social connections. Graph stores include Neo4J and Giraph.
- **Key-value stores** are the simplest NoSQL databases. Every single item in the database is stored as an attribute name (or 'key'), together with its value. Examples of key-value stores are Riak and Berkeley DB. Some key-value stores, such as Redis, allow each value to have a type, such as 'integer', which adds functionality.
- **Wide-column stores** such as Cassandra and HBase are optimized for queries over large datasets, and store columns of data together, instead of rows.

The Benefits of NoSQL

- When compared to relational databases, NoSQL databases are performance, and their data model addresses several issues that the relational model is not designed to address:
- Large volumes of rapidly changing structured, semi-structured, and unstructured data
- Agile sprints, quick schema iteration, and frequent code pushes
- Object-oriented programming that is easy to use and flexible
- Geographically distributed scale-out architecture instead of expensive, monolithic architecture

Proprietary Application Server to Open Source Application Server

<Insert Text Here>

Proprietary Portal to Open Source Portal

<Insert Text Here>

Proprietary BPMS to Open Source BPMS

<Insert Text Here>

SOA Enablement

<Insert Text Here>

Mobile Enablement

<Insert Text Here>

2 New Development Efforts

<Insert Text Here>

3 Open Source (DB, App Server, ESB, BPMS, Rule Engine)

<Insert Text Here>

4 SOA/Microservices

<Insert Text Here>

5 Mobile “Module”

<Insert Text Here>

6 Database selection criteria, scenarios and process

RDBMS vs NoSQL

1. Complexity of data model
2. Volatility of data model
3. Coding velocity and agility
4. Scalability
5. Performance
6. Reporting (“slicing and dicing”)
7. Other criteria

Outcome:

a) RDBMS

<Insert Text Here>

b) NoSQL

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c) Combination of RDBMS and NoSQL

RDBMS

Open Source vs. proprietary

a. MySQL

i. Introduction

Most relational databases were designed for complex ERP-type applications, MySQL was designed and optimized for Web applications. As new and different requirements emerged with the Internet, MySQL became the platform of choice for web developers, and the default database for web-based applications. Performance & scalability, reliability, and ease of use of this open source database, characteristics that made MySQL the top choice for web applications, have relentlessly been improved. MySQL is also evolving to remain the premier choice for web-based

and Cloud-based applications; and is integrated within numerous Big Data platforms. Many of the world's largest and fastest-growing organizations including Facebook, Google, Adobe, Alcatel Lucent and Zappos rely on MySQL to save time and money powering their high-volume Web sites, business-critical systems and packaged software.

ii. Strengths

Advantages:

- **Scalability and Flexibility**

The MySQL database server provides the ultimate in scalability, sporting the capacity to handle deeply embedded applications with a footprint of only 1MB to running massive data warehouses holding terabytes of information. Platform flexibility is a stalwart feature of MySQL with all flavors of Linux, UNIX, and Windows being supported. And, of course, the open source nature of MySQL allows complete customization for those wanting to add unique requirements to the database server.

- **High Performance**

A unique storage-engine architecture allows database professionals to configure the MySQL database server specifically for particular applications, with the end result being amazing performance results. Whether the intended application is a high-speed transactional processing system or a high-volume web site that services a billion queries a day, MySQL can meet the most demanding performance expectations of any system. With high-speed load utilities, distinctive memory caches, full text indexes, and other performance-enhancing mechanisms, MySQL offers all the right ammunition for today's critical business systems.

- **High Availability**

Rock-solid reliability and constant availability are hallmarks of MySQL, with customers relying on MySQL to guarantee around-the-clock uptime. MySQL offers a variety of high-availability options from high-speed master/slave replication configurations, to specialized Cluster servers offering instant failover, to third party vendors offering unique high-availability solutions for the MySQL database server.

- **Robust Transactional Support**

MySQL offers one of the most powerful transactional database engines on the market. Features include complete ACID (atomic, consistent, isolated, durable) transaction support, unlimited row-level locking, distributed transaction capability, and multi-version transaction support where readers never block writers and vice-versa. Full data integrity is also assured through server-enforced referential integrity, specialized transaction isolation levels, and instant deadlock detection.

- **Web and Data Warehouse Strengths**

MySQL is the de-facto standard for high-traffic web sites because of its high-performance query engine, tremendously fast data insert capability, and strong support for specialized web functions like fast full text searches. These same strengths also apply to data warehousing environments where MySQL scales up into the terabyte range for either single servers or scale-out architectures. Other features like main memory tables, B-tree and hash indexes, and compressed archive tables that reduce storage requirements by up to eighty-percent make MySQL a strong standout for both web and business intelligence applications.

- **Strong Data Protection**

Because guarding the data assets of corporations is the number one job of database professionals, MySQL offers exceptional security features that ensure absolute data protection. In terms of database authentication, MySQL provides powerful mechanisms for ensuring only authorized users have entry to the database server, with the ability to block users down to the client machine level being possible. SSH and SSL support are also provided to ensure safe and secure connections. A granular object privilege framework is present so that users only see the data they should, and powerful data encryption and decryption functions ensure that sensitive data is protected from unauthorized viewing. Finally, backup and recovery utilities provided through MySQL and third party software vendors allow for complete logical and physical backup as well as full and point-in-time recovery.

- **Comprehensive Application Development**

One of the reasons MySQL is the world's most popular open source database is that it provides comprehensive support for every application development need. Within the database, support can be found for stored procedures, triggers, functions, views, cursors, ANSI-standard SQL, and more. For embedded applications, plug-in libraries are available to embed MySQL database support into nearly any application. MySQL also provides connectors and drivers (ODBC, JDBC, etc.) that allow all forms of applications to make use of MySQL as a preferred data management server. It doesn't matter if it's PHP, Perl, Java, Visual Basic, or .NET, MySQL offers application developers everything they need to be successful in building database-driven information systems.

- **Management Ease**

MySQL offers exceptional quick-start capability with the average time from software download to installation completion being less than fifteen minutes. This rule holds true whether the platform is Microsoft Windows, Linux, Macintosh, or UNIX. Once installed, self-management features like automatic space expansion, auto-restart, and dynamic configuration changes take much of the burden off already overworked database administrators. MySQL also provides a complete suite of graphical management and migration tools that allow a DBA to manage, troubleshoot, and control the operation of many MySQL servers from a single workstation. Many third party software vendor tools are also available for MySQL that handle tasks ranging from data design and ETL, to complete database administration, job management, and performance monitoring.

- **Open Source Freedom and 24 x 7 Support**

Many corporations are hesitant to fully commit to open source software because they believe they can't get the type of support or professional service safety nets they currently rely on with proprietary software to ensure the overall success of their key applications. The questions of indemnification come up often as well. These worries can be put to rest with MySQL as complete around-the-clock support as well as indemnification is available through MySQL Enterprise. MySQL is not a typical open source project as all the software is owned and supported by Oracle, and because of this, a unique cost and support model are available that provides a unique combination of open source freedom and trusted software with support.

- **Lowest Total Cost of Ownership**

By migrating current database-drive applications to MySQL, or using MySQL for new development projects, corporations are realizing cost savings that many times stretch into seven figures. Accomplished through the use of the MySQL database server and scale-out architectures that utilize low-cost commodity hardware, corporations are finding that they can achieve amazing levels of scalability and performance, all at a cost that is far less than those offered by proprietary and scale-up software vendors. In addition, the reliability and easy maintainability of MySQL means that database administrators don't waste time troubleshooting performance or downtime issues.

Cross-platform Availability

MySQL is about flexibility and choice. Users have the ability to run MySQL on all major platforms, and to write applications in all popular language.

Supported Operating Systems	Supported Languages
Oracle/RedHat Enterprise Linux	PHP
Fedora Linux	Perl
Ubuntu Linux	Python
Debian Linux	Java
SuSE Linux	C
Oracle Solaris	C++
Microsoft Windows	C#
Apple Mac OS	Ruby

Cost

MySQL Community Edition is the freely downloadable version of the world's most popular open source database.

	MySQL Standard Edition	MySQL Enterprise Edition	MySQL Cluster Carrier Grade Edition
Annual Subscription	USD 2,000	USD 5,000	USD 10,000
Oracle Premier Support			
24x7 Support	√	√	√
Unlimited Support Incidents	√	√	√
Knowledge Base	√	√	√
Maintenance Releases	√	√	√
MySQL Consultative Support	√	√	√
MySQL Features			
MySQL Database Server	√	√	√
MySQL Connectors	√	√	√
MySQL Replication	√	√	√

MySQL Fabric		√	√
MySQL Router		√	√
MySQL Partitioning		√	√
MySQL Utilities		√	√
MySQL Workbench	√	√	√
Storage Engine: MyISAM	√	√	√
Storage Engine: InnoDB	√	√	√
Storage Engine: NDB			√
Oracle Enterprise Manager for MySQL		√	√
MySQL Enterprise Monitor		√	√
MySQL Enterprise Dashboard ¹		√	√
MySQL Enterprise Advisors		√	√
MySQL Query Analyzer		√	√
MySQL Replication Monitor		√	√
MySQL Enterprise Backup		√	√
Hot backup for InnoDB		√	√
Full, Incremental, Partial, Optimistic Backups		√	√
Full, Partial, Selective, Hot Selective restore		√	√
Encryption and Compression		√	√
Point-In-Time-Recovery		√	√
MySQL Enterprise Security		√	√
MySQL Enterprise Authentication		√	√
MySQL Enterprise TDE		√	√
MySQL Enterprise Encryption		√	√
MySQL Enterprise Firewall		√	√
MySQL Enterprise Audit		√	√
MySQL Enterprise Scalability		√	√
Thread Pool		√	√

MySQL Enterprise High-Availability		√	√
HA using Oracle Clusterware		√	√
HA using Solaris Clustering		√	√
MySQL Cluster Manager			√
Configuration & Provisioning			√
Automatic Scaling			√
Management & Monitoring			√
MySQL Cluster Geo-Replication			√

iii. Weaknesses

- Lack of certain SQL features
- Lack of thorough testing on certain platforms
- Difficulty of working with the source code

iv. Recommended use

<Insert Text Here>

b. PostgreSQL

i. Introduction

PostgreSQL is a powerful, open source object-relational database system. It runs on all major operating systems, including Linux, UNIX (AIX, BSD, HP-UX, SGI IRIX, Mac OS X, Solaris, Tru64), and Windows. It is fully ACID compliant, has full support for foreign keys, joins, views, triggers, and stored procedures (in multiple languages). It includes most SQL data types, including INTEGER, NUMERIC, BOOLEAN, CHAR, VARCHAR, DATE, INTERVAL, and TIMESTAMP. It also supports storage of binary large objects, including pictures, sounds, or video. PostgreSQL runs stored procedures in more than a dozen programming languages, including Java, Perl, Python, Ruby, Tcl, C/C++, and its own PL/pgSQL, which is similar to Oracle's PL/SQL. An enterprise class database, PostgreSQL boasts sophisticated features such as Multi-Version Concurrency Control (MVCC), point in time recovery, tablespaces, asynchronous replication, nested transactions (savepoints), online/hot backups, a sophisticated query planner/optimizer, and write ahead logging for fault tolerance. It supports international character sets, multibyte character encodings, Unicode, and it is locale-aware for sorting, case-sensitivity, and formatting. It is highly scalable both in the sheer quantity of data it can manage and in the number of concurrent users it can accommodate. Best of all, PostgreSQL's source code is available under a liberal open source license.

ii. Strengths

Advantages:

- Immunity to over-deployment

Over-deployment is what some proprietary databases regard as their top license compliance problem. With PostgreSQL, there is no licensing agreements breach, as there is no associated licensing cost for the software.

This has several additional advantages:

- More profitable business models with wide-scale deployment.
- No possibility of being audited for license compliance at any stage.
- Flexibility to do concept research and trial deployments without needing to include additional licensing costs.

- **Significant saving on staffing costs**

The software has been designed and created to have much lower maintenance and tuning requirements than the leading proprietary databases, yet still retain all of the features, stability, and performance.

In addition to this, progressql training programs are generally regarded as being far more cost effective, manageable, and practical than that of the other leading proprietary database vendors.

- **Reliability and stability**

Unlike many proprietary databases, many companies report that PostgreSQL has never, ever crashed in several years of high activity operations.

- **Extensible**

Source code is available to everyone at no charge. This gives the ability to customize or extend PostgreSQL in any way with a minimum of effort, and with no attached costs.

- **Cross platform**

PostgreSQL is available for almost every brand of UNIX (34 platforms with the latest stable release), and Windows compatibility is available via the Cygwin framework. Native Windows compatibility is also available with version 8.0 and above.

Designed for high volume environments

PostgreSQL uses a multiple row data storage strategy called MVCC to make it extremely responsive in high volume environments.

- **GUI database design and administration tools**

There are many high-quality GUI Tools available for PostgreSQL from both open source developers and commercial providers.

Cross-platform Availability

Supported Operating Systems	Supported Languages
Linux	.Net
Unix	Perl
AIX	Python
BSD	Java
HP UX	C/C++
Solaris	Ruby
Microsoft Windows	Tcl
Mac OS X	PL/pgSQL

Cost

PostgreSQL is released under the PostgreSQL License, a liberal Open Source license, similar to the BSD or MIT licenses.

iii. Weaknesses

- **Performance:**

For simple *read*-heavy operations, PostgreSQL can be an over-kill and might appear less performant than the counterparts, such as MySQL.

- **Popularity:**

Given the nature of this tool, it lacks behind in terms of popularity, despite the very large amount of deployments - which might affect how easy it might be possible to get support.

- **Hosting:**

Due to above mentioned factors, it is harder to come by hosts or service providers that offer managed PostgreSQL instances.

iv. Recommended use

<Insert Text Here>

c. Oracle

i. Introduction

Oracle database (Oracle DB) is a relational database management system (RDBMS) from the Oracle Corporation. Originally developed in 1977 by Lawrence Ellison and other developers, Oracle DB is one of the most trusted and widely-used relational database engines. The system is built around a relational database framework in which data objects may be directly accessed by users (or an application front end) through structured query language (SQL). Oracle is a fully scalable relational database architecture and is used by global enterprises, which manage and process data across wide and local area networks. The Oracle database has its own network component to allow communications across networks. Oracle DB is also known as Oracle RDBMS and, sometimes, just Oracle.

Oracle DB runs on most major platforms, including Windows, UNIX, Linux and Mac OS. Different software versions are available, based on requirements and budget. Oracle DB editions are hierarchically broken down as follows:

- Enterprise Edition: Offers all features, including superior performance and security, and is the most robust
- Standard Edition: Contains base functionality for users that do not require Enterprise Edition's robust package
- Express Edition (XE): The lightweight, free and limited Windows and Linux edition
- Oracle Lite: For mobile devices

A key feature of Oracle is that its architecture is split between the logical and the physical. This structure means that for large-scale distributed computing, also known as grid computing, the data location is irrelevant and transparent to the user, allowing for a more modular physical structure that can be added to and altered without affecting the activity of the database, its data or users. The sharing of resources in this way allows for very flexible data networks whose capacity can be adjusted up or down to suit demand, without degradation of service. It also allows for a

robust system to be devised as there is no single point at which a failure can bring down the database, as the networked schema of the storage resources means that any failure would be local only.

Oracle Database competes against commercial products such as IBM's DB2 UDB and Microsoft SQL Server. Oracle and IBM tend to battle for the mid-range database market on UNIX and Linux platforms, while Microsoft dominates the mid-range database market on Microsoft Windows platforms. Commercial competitors include Teradata (in data warehousing and business intelligence), Software AG's ADABAS, Sybase, and IBM's Informix, among many others. Oracle database products compete against open-source software relational database systems as PostgreSQL, Firebird, and MySQL. Oracle acquired Innobase, supplier of the InnoDB codebase to MySQL, in part to compete better against open source alternatives, and acquired Sun Microsystems, owner of MySQL, in 2010.

Oracle current version

- Oracle Database 12c Release 1: 12.1.0.1 (Patchset as of June 2013)
- Oracle Database 12c Release 1: 12.1.0.2 (Patchset as of July 2014)

Supported platform

Oracle Database 12c is supported on the following OS and architecture combinations:

- Linux on x86-64 (only Red Hat Enterprise Linux, Oracle Linux and SUSE distributions are supported[91])
- Microsoft Windows on x86-64
- Oracle Solaris on SPARC and x86-64
- IBM AIX on POWER Systems
- IBM Linux on z Systems
- HP-UX on Itanium

Edition Comparison

	Express Edition	Standard Edition One	Standard Edition	Enterprise Edition
Maximum	1 CPU	2 Sockets	4 Sockets	No Limit
RAM	1GB	OS Max	OS Max	OS Max
Database Size	11GB	No Limit	No Limit	No Limit
Oracle Multitenant				Option
	Big Data and Data Warehousing			

Oracle Advanced Compression				Option
Oracle OLAP				Option
Oracle Partitioning				Option
Oracle Advanced Analytics				Option
Transportable Tablespaces, Including Cross-Platform				●
Star Query Optimization	PL/SQL only	●	●	●
Summary Management - Materialized View Query Rewrite				●
Information Lifecycle Management				●
	High Availability			
Oracle Active Data Guard				Option
Data Guard				●
Transaction Guard				●
Cross-Platform Recovery				●
Cross-Platform Backup				●
Fail Safe		●	●	●
Flashback Query	●	●	●	●

Flashback Table, Database and Transaction Query				●
Oracle Secure Backup		Oracle Secure Backup is its own product that works with each Oracle Database edition.		
Server Managed Backup and Recovery		●	●	●
	Performance and Scalability			
Oracle Real Application Clusters			●	Option
Oracle Real Application Clusters One Node				Option
Adaptive Execution Plans				●
Integrated Clusterware		●	●	●
Automatic Workload Management			●	●
Java, PL/SQL Native Compilation	PL/SQL only	●	●	●
Oracle In-Memory Database Cache				Option
	Security Defense in Depth			
Data Masking				Requires Oracle Data Masking Pack
Real Application Security				●

Oracle Database Vault				Option
Oracle Audit Vault and Database Firewall		Oracle Audit Vault is its own product that works with each Oracle Database edition.		
Oracle Advanced Security				Option
Oracle Label Security				Option
Secure Application Roles				●
Oracle Virtual Private Database				●
Fine-Grained Auditing				●
Proxy Authentication		●	●	●
Data Encryption Toolkit	●	●	●	●
	Application Development			
Oracle Flashback Data Archive		●	●	●
SQL Pattern Matching		●	●	●
Temporal Database		●	●	●
Oracle SQL Developer	●	●	●	●
Oracle Application Express	●	●	●	●
Java Support		●	●	●

Comprehensive XML Support	●	●	●	●
PL/SQL	PL/SQL only	●	●	●
Comprehensive Microsoft .Net Support, OLE DB, ODBC	●	●	●	●
	Manageability			
Oracle Real Application Testing				Option
Oracle Enterprise Manager		●	●	●
Automatic Memory Management	●	●	●	●
Oracle Automatic Storage Management		●	●	●
Automatic Undo Management	●	●	●	●
	Integration			
Basic Replication		●	●	●
Distributed Queries/Transactions	●	●	●	●
	Unstructured Data Management			
Oracle Spatial and Graph				Option
XML DB	●	●	●	●
Multimedia		●	●	●

Text	●	●	●	●
Locator	●	●	●	●
Oracle Secure Enterprise Search		Oracle Secure Enterprise Search is its own product that works with each Oracle Database edition.		

ii. Strengths

Advantages of Oracle

- **Portability**

Oracle can be ported to more platforms than any of its competition, running on more than 100 hardware platforms and 20 networking protocols.

- **Market Presence**

Oracle is by far the largest RDBMS Vendor, and spends more on R&D than most of its competitors earn in total revenue. Oracle has the largest independent RDBMS market share in VMS, UNIX and OS/2 Server fields. This market clout means that proficient staff in Oracle are relatively easy to get.

- **Integrated Software Stack**

Oracle's product research and engineering expertise spans the entire stack — from storage, networks, compute and operating systems, to middleware, enterprise applications and databases — and is integrated and validated to work together to take the guesswork out of deploying complex solutions.

- **Availability & Reliability**

Oracle servers are built to maximize uptime and ensure fast recovery from failures. These systems feature hot-swappable, hot-pluggable, and redundant components, as well as advanced integration (low parts count) and superior energy efficiency to reduce faults due to thermal conditions. Oracle Solaris Dynamic Tracing (DTrace) helps administrators and application developers to find problems in code as it executes on production systems without significant performance overhead. The Oracle Database has built-in features to provide high availability, such as fast-start fault recovery, Oracle Real Application Clusters (RAC) and Oracle Clusterware, Oracle Data Guard, and Oracle Automatic Storage Management (ASM).

- **Performance**

Oracle Database software is optimized for the highest possible performance. Proven concurrency techniques ensure maximum throughput for all workloads. When run on a clustered system, workloads are automatically balanced across available machines in the cluster, delivering optimal performance and hardware utilization.

- **Scalability**

Oracle technologies are designed with scalability and agility and have it in their DNA to scale. Oracle servers were among the first to support multiple processors, multiple cores, and continued

to lead the industry with innovations in multithreading capability. Today, Oracle servers scale within the box and the latest engineered systems can scale up to eight racks.

- **Manageability**

Administrators and other IT staff need visibility into, and control over, the entire landscape. Integrated management is a critical enabler of Oracle's applications-to-disk strategy, and is made possible by the deep integration of Oracle Enterprise Manager (OEM) and Oracle Enterprise Manager Ops Center software.

- **Security and Compliance**

Oracle's integrated infrastructure helps ensure that compliance and security requirements are met. For example, Oracle Database provides a number of features to promote security, including transparent data encryption, Oracle Database Vault, Encryption features, Digital signatures, secure execution, Role-based access controls and Secure by default.

iii. Weaknesses

<Insert Text Here>

iv. Recommended use

<Insert Text Here>

NoSQL

d. Hadoop

i. Introduction

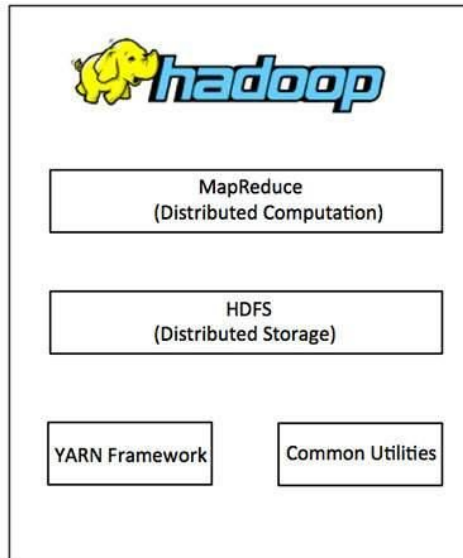
Hadoop is an open-source framework that allows to store and process big data in a distributed environment across clusters of computers using simple programming models. It is designed to scale up from single servers to thousands of machines, each offering local computation and storage.

Hadoop is an Apache open source framework written in java that allows distributed processing of large datasets across clusters of computers using simple programming models. A Hadoop frame-worked application works in an environment that provides distributed storage and computation across clusters of computers. Hadoop is designed to scale up from single server to thousands of machines, each offering local computation and storage.

Hadoop Architecture

Hadoop framework includes following four modules:

- **Hadoop Common:** These are Java libraries and utilities required by other Hadoop modules. These libraries provides filesystem and OS level abstractions and contains the necessary Java files and scripts required to start Hadoop.
- **Hadoop YARN:** This is a framework for job scheduling and cluster resource management.
- **Hadoop Distributed File System (HDFS™):** A distributed file system that provides high-throughput access to application data.
- **Hadoop MapReduce:** This is YARN-based system for parallel processing of large data sets.
- We can use following diagram to depict these four components available in Hadoop framework.



Since 2012, the term "Hadoop" often refers not just to the base modules mentioned above but also to the collection of additional software packages that can be installed on top of or alongside Hadoop, such as Apache Pig, Apache Hive, Apache HBase, Apache Spark etc.

MapReduce

Hadoop MapReduce is a software framework for easily writing applications which process big amounts of data in-parallel on large clusters (thousands of nodes) of commodity hardware in a reliable, fault-tolerant manner.

The term MapReduce actually refers to the following two different tasks that Hadoop programs perform:

- The Map Task: This is the first task, which takes input data and converts it into a set of data, where individual elements are broken down into tuples (key/value pairs).
- The Reduce Task: This task takes the output from a map task as input and combines those data tuples into a smaller set of tuples. The reduce task is always performed after the map task.

Typically both the input and the output are stored in a file-system. The framework takes care of scheduling tasks, monitoring them and re-executes the failed tasks.

The MapReduce framework consists of a single master JobTracker and one slave TaskTracker per cluster-node. The master is responsible for resource management, tracking resource consumption/availability and scheduling the jobs component tasks on the slaves, monitoring them and re-executing the failed tasks. The slaves TaskTracker execute the tasks as directed by the master and provide task-status information to the master periodically.

The JobTracker is a single point of failure for the Hadoop MapReduce service which means if JobTracker goes down, all running jobs are halted.

Hadoop Distributed File System

Hadoop can work directly with any mountable distributed file system such as Local FS, HFTP FS, S3 FS, and others, but the most common file system used by Hadoop is the Hadoop Distributed File System (HDFS).

The Hadoop Distributed File System (HDFS) is based on the Google File System (GFS) and provides a distributed file system that is designed to run on large clusters (thousands of computers) of small computer machines in a reliable, fault-tolerant manner.

HDFS uses a master/slave architecture where master consists of a singleNameNode that manages the file system metadata and one or more slaveDataNodes that store the actual data.

A file in an HDFS namespace is split into several blocks and those blocks are stored in a set of DataNodes. The NameNode determines the mapping of blocks to the DataNodes. The DataNodes takes care of read and write operation with the file system. They also take care of block creation, deletion and replication based on instruction given by NameNode.

HDFS provides a shell like any other file system and a list of commands are available to interact with the file system. These shell commands will be covered in a separate chapter along with appropriate examples.

How Does Hadoop Work?

- Stage 1
 - A user/application can submit a job to the Hadoop (a hadoop job client) for required process by specifying the following items:
 - The location of the input and output files in the distributed file system.
 - The java classes in the form of jar file containing the implementation of map and reduce functions.
 - The job configuration by setting different parameters specific to the job.
- Stage 2
 - The Hadoop job client then submits the job (jar/executable etc) and configuration to the JobTracker which then assumes the responsibility of distributing the software/configuration to the slaves, scheduling tasks and monitoring them, providing status and diagnostic information to the job-client.
- Stage 3
 - The TaskTrackers on different nodes execute the task as per MapReduce implementation and output of the reduce function is stored into the output files on the file system.

ii. Strengths

- Hadoop framework allows the user to quickly write and test distributed systems. It is efficient, and it automatic distributes the data and work across the machines and in turn, utilizes the underlying parallelism of the CPU cores.
- Hadoop does not rely on hardware to provide fault-tolerance and high availability (FTHA), rather Hadoop library itself has been designed to detect and handle failures at the application layer.
- Servers can be added or removed from the cluster dynamically and Hadoop continues to operate without interruption.
- Another big advantage of Hadoop is that apart from being open source, it is compatible on all the platforms since it is Java based.

- Distribute data and computation. The computation local to data prevents the network overload.
- Tasks are independent. The tasks are independent so,
- We can easily handle partial failure. Here the entire nodes can fail and restart.
- It avoids crawling horrors of failure and tolerant synchronous distributed systems.
- Speculative execution to work around stragglers.
- Linear scaling in the ideal case. It is used to design for cheap, commodity hardware.
- Simple programming model. The end-user programmer only writes map-reduce tasks.
- Flat scalability:- This is the one advantage of using Hadoop in contrast to other distributed systems is its flat scalability curve. Executing Hadoop on a limited amount of data on a small number of nodes may not demonstrate particularly stellar performance as the overhead involved in starting Hadoop programs is relatively high. Other parallel/distributed programming paradigms such as MPI (Message Passing Interface) may perform much better on two, four, or perhaps a dozen machines. Though the effort of coordinating work among a small number of machines may be better-performed by such systems the price paid in performance and engineering effort (when adding more hardware as a result of increasing data volumes) increases non-linearly
- HDFS stores large amount of information
- HDFS is simple and robust coherency model
- That is it should store data reliably.
- HDFS is scalable and fast access to this information and it is also possible to serve a large number of clients by simply adding more machines to the cluster.
- HDFS should integrate well with Hadoop MapReduce, allowing data to be read and computed upon locally when possible.
- HDFS provides streaming read performance.
- Data will be written to the HDFS once and then read several times.
- The overhead of caching is helped the data should simply be re-read from HDFS source.
- Fault tolerance by detecting faults and applying quick, automatic recovery
- Processing logic close to the data, rather than the data close to the processing logic
- Portability across heterogeneous commodity hardware and operating systems
- Economy by distributing data and processing across clusters of commodity personal computers
- Efficiency by distributing data and logic to process it in parallel on nodes where data is located
- Reliability by automatically maintaining multiple copies of data and automatically redeploying processing logic in the event of failures
- HDFS is a block structured file system: – Each file is broken into blocks of a fixed size and these blocks are stored across a cluster of one or more machines with data storage capacity
- Ability to write MapReduce programs in Java, a language which even many non-computer scientists can learn with sufficient capability to meet powerful data-processing needs
- Ability to rapidly process large amounts of data in parallel
- Can be deployed on large clusters of cheap commodity hardware as opposed to expensive, specialized parallel-processing hardware

- Can be offered as an on-demand service, for example as part of Amazon's EC2 cluster computing service

iii. **Weaknesses**

- Rough manner: - Hadoop Map-reduce and HDFS are rough in manner. Because the software under active development.
- Programming model is very restrictive: - Lack of central data can be preventive.
- Joins of multiple datasets are tricky and slow: - No indices! Often entire dataset gets copied in the process.
- Cluster management is hard: - In the cluster, operations like debugging, distributing software, collection logs etc. are too hard.
- Still single master which requires care and may limit scaling
- Managing job flow isn't trivial when intermediate data should be kept
- Optimal configuration of nodes not obvious. Eg: – #mappers, #reducers, mem.limits
- If you want to do some Real Time Analytics, where you are expecting result quickly, Hadoop should not be used directly. It is because Hadoop works on batch processing, hence response time is high.

iv. **Recommended use**

In the past couple of years, Hadoop has earned the title of “THE Big Data Analytics Platform”. To a lot of organizations, it is equal to the term Big Data Technology. But it can only do so much and savvy organizations need to analyze their needs in order to see if it is a good fit to their Big Data related needs. Hadoop has ample power to process voluminous data sets, but organizations need to assess their needs in order to know when to use Hadoop and when to look for alternative solutions.

Example: Metamarkets

For instance, Hadoop has a lot of horsepower to process huge amounts of unstructured, semi-structured and structured data alike. But it falls short when it comes to processing smaller data sets. Metamarkets is one such company which has little use of Hadoop because of this limitation. Although they use Hadoop to process huge data sets where time isn't of the essence, but when it comes to providing with real-time analytics they use other solutions. It is because Hadoop isn't optimized to execute batch jobs which look at every single file in the database. All their requirements come down to a tradeoff: in order to make the connections between the data points, Hadoop detracts the speed.

They use Hadoop for the reports at the end of every day, which helps them review all the transactions of the day, or when they have to scan the historical data which dates back numerous months. Their CEO says that using Hadoop is like having a pen pal, you can write to him, but you won't be getting an instant reply, unlike IMs.

Not a true replacement to the traditional database

While some organizations might be tempted to scrape their traditional databases and the warehouse in favor of Hadoop clusters, because of the lower technology costs, many experts say that this is like comparing apples to oranges. As they believe, the relational databases which power most of the deployed data warehouses are used to accommodate small amounts of data which trickles in at a very steady rate over a time span. Hadoop is more apt to process the stores of data which has been accumulated over a lot of time.

And because Hadoop is usually employed in huge projects which require clusters of service hardware with employees specialized to handle the programming and have ample data management skills, the implementation can amass quite a lot of expenses. Even though the cost-per-unit of data is lower than that of the relational databases, adding everything shows that it isn't as cheap as it seemed.

Requirement based application

A great example application of Hadoop would be acting as the data integration area for executing the ETL (extract, transform, and load) tasks. Although, this application doesn't live up to the up, but it makes perfect sense when your IT dept. needs to merge huge files. In such a case, the immense power of Hadoop can be very useful in processing.

Many experts believe that Hadoop can be very helpful when handling the ETL procedure because it can split the tasks amongst the numerous nodes, speeding up the process a lot. Also, Hadoop can be used to integrate the data and then stage it for later loading into a relational database or a data warehouse, which justifies the investment in this platform.

Final Words

Hadoop is a behemoth and it is definitely capable of everything that Apache claims, but getting it through the door for bigger projects which employ Hadoop's flexibility and scalability to a bigger scale seems like the saner thing to do.

e. MongoDB

i. Introduction

MongoDB is a cross-platform, document oriented NoSQL database that provides, high performance, high availability, and easy scalability. MongoDB works on concept of collection and document. Collection is a group of MongoDB documents. It is the equivalent of an RDBMS table. A collection exists within a single database. Collections do not enforce a schema. Documents within a collection can have different fields. Typically, all documents in a collection are of similar or related purpose. A document is a set of key-value pairs. Documents have dynamic schema. Dynamic schema means that documents in the same collection do not need to have the same set of fields or structure, and common fields in a collection's documents may hold different types of data.

ii. Strengths

Advantages of MongoDB over RDBMS

- Schema less: MongoDB is document database in which one collection holds different documents. Number of fields, content and size of the document can be differ from one document to another.
- Structure of a single object is clear
- No complex joins
- Deep query-ability. MongoDB supports dynamic queries on documents using a document-based query language that's nearly as powerful as SQL
- Tuning
- Ease of scale-out: MongoDB is easy to scale
- Conversion / mapping of application objects to database objects not needed

- Uses internal memory for storing the (windowed) working set, enabling faster access of data

iii. Weaknesses

- Big Data
- Content Management and Delivery
- Mobile and Social Infrastructure
- User Data Management
- Data Hub

iv. Recommended use

Why should use MongoDB?

- Document Oriented Storage: Data is stored in the form of JSON style documents
- Index on any attribute
- Replication & High Availability
- Auto-Sharding
- Rich Queries
- Fast In-Place Updates
- Professional Support By MongoDB

Where should use MongoDB?

- Big Data
- Content Management and Delivery
- Mobile and Social Infrastructure
- User Data Management
- Data Hub

Cost

MongoDB Database Community Server and Tools are free. Commercial licenses are also available from MongoDB, Inc. for MongoDB Enterprise Advanced and MongoDB Professional Editions.

SQL Vs NoSQL

Use an RDBMS when you need/have...	Use NoSQL when you need/have...
Centralized applications (e.g. ERP)	Decentralized applications (e.g. Web, mobile and IOT)
Moderate to high availability	Continuous availability; no downtime
Moderate velocity data	High velocity data (devices, sensors, etc.)
Data coming in from one/few locations	Data coming in from many locations
Primarily structured data	Structured, with semi/unstructured
Complex/nested transactions	Simple transactions
Primary concern is scaling reads	Concern is to scale both writes and reads
Philosophy of scaling up for more users/data	Philosophy of scaling out for more users/data

To maintain moderate data volumes with purge	To maintain high data volumes; retain forever
--	---

	SQL	NoSQL
Options	MySQL SQL Server Oracle PostgreSQL	NoSQL MongoDB Hadoop
Stores (contents)	related data tables	JSON-like field-value pair documents / collections
Schema	Yes: definitions first (types, keys, functionality)	No: define as insert data
Normalization (reduce redundancy)	Yes: requires design of schema	Both: requires design of collection
	used more: joins	used less: can mean faster queries, slower updates
	more db logic	more app logic
Data integrity	enforced via schema rules	requires design (single doc as sole source of all info about an item)
Transactions	wrapped for success/fail	no updates to multiple documents
Queries	powerful	complexity can become convoluted
Speed	slower	faster
Scaling	more difficult with SQL	easier: simpler data model
Product maturity	more mature	less mature: may be more issues, harder to staff
Ideal project	data requirements concrete data integrity essential proven technology + staff	evolving data requirements looser project objectives speed and scalability is imperative

	SQL Databases	NOSQL Databases
Types	One type (SQL database) with minor variations	Many different types including key-value stores, document databases, wide-column stores, and graph databases
Development History	Developed in 1970s to deal with first wave of data storage applications	Developed in late 2000s to deal with limitations of SQL databases, especially scalability, multi-structured data, geo-distribution and agile development sprints
Examples	MySQL, Postgres, Microsoft SQL Server, Oracle Database	MongoDB, Cassandra, HBase, Neo4j

Data Storage Model	Individual records (e.g., 'employees') are stored as rows in tables, with each column storing a specific piece of data about that record (e.g., 'manager,' 'date hired,' etc.), much like a spreadsheet. Related data is stored in separate tables, and then joined together when more complex queries are executed. For example, 'offices' might be stored in one table, and 'employees' in another. When a user wants to find the work address of an employee, the database engine joins the 'employee' and 'office' tables together to get all the information necessary.	Varies based on database type. For example, key-value stores function similarly to SQL databases, but have only two columns ('key' and 'value'), with more complex information sometimes stored as BLOBs within the 'value' columns. Document databases do away with the table-and-row model altogether, storing all relevant data together in single 'document' in JSON, XML, or another format, which can nest values hierarchically.
Schemas	Structure and data types are fixed in advance. To store information about a new data item, the entire database must be altered, during which time the database must be taken offline.	Typically dynamic, with some enforcing data validation rules. Applications can add new fields on the fly, and unlike SQL table rows, dissimilar data can be stored together as necessary. For some databases (e.g., wide-column stores), it is somewhat more challenging to add new fields dynamically.
Scaling	Vertically, meaning a single server must be made increasingly powerful in order to deal with increased demand. It is possible to spread SQL databases over many servers, but significant additional engineering is generally required, and core relational features such as JOINS, referential integrity and transactions are typically lost.	Horizontally, meaning that to add capacity, a database administrator can simply add more commodity servers or cloud instances. The database automatically spreads data across servers as necessary.
Development Model	Mix of open-source (e.g., Postgres, MySQL) and closed source (e.g., Oracle Database)	Open-source
Supports Transactions	Yes, updates can be configured to complete entirely or not at all	In certain circumstances and at certain levels (e.g., document level vs. database level)
Data Manipulation	Specific language using Select, Insert, and Update statements, e.g. SELECT fields FROM table WHERE...	Through object-oriented APIs
Consistency	Can be configured for strong consistency	Depends on product. Some provide strong consistency (e.g., MongoDB, with tunable consistency for reads) whereas others offer eventual consistency (e.g., Cassandra).

Oracle Vs MySQL

Features/Functionality	MySQL	Oracle

Strengths	Price/Performance Great performance when applications leverage architecture.	Aircraft carrier database capable of running large OLTP and VLDBs.
Database Products	Enterprise (\$) – supported, more stable. Community (free) – more leading edge.	Enterprise (\$\$\$\$) Standard (\$\$) Standard One (\$) Express (free) – up to 4GB
Application Perspective	Web applications often don't leverage database server functionality. Web apps more concerned with fast reads.	More you do in the database the more you will love Oracle with compiled PL/SQL, XML, APEX, Java, etc.
Administration	Can be trivial to get it setup and running. Large and advanced configurations can get complex.	Requires lots of in-depth knowledge and skill to manage large environments. Can get extremely complex but also very powerful.
Popularity	Extremely popular with web companies, startups, small/medium businesses, small/medium projects.	Extremely popular in Fortune 100, medium/large enterprise business applications and medium/large data warehouses.
Application Domains (most popular)	Web (MySQL excels) Data Warehouse Gaming Small/medium OLTP environments	Medium/Large OLTP and enterprise applications. Oracle excels in large business applications (EBS, Siebel, PeopleSoft, JD Edwards, Retek, ...) Medium/Large data warehouse
Development Environments (most common)	1) PHP 2) Java 3) Ruby on Rails 4) .NET 5) Perl	1) Java 2) .NET 3) APEX 4) Ruby on Rails 5) PHP Note: Oracle focusing on Java for next generation business applications.
Database Server (Instance)	Database Instance stores global memory in mysqld background process. User sessions are managed through threads.	Database instance has numerous background processes dependent on configuration. System Global Area is shared memory for SMON, PMON, DBWR, LGWR, ARCH, RECO, etc. Sessions are managed through server processes.

Database Server (Physical Storage)	<p>Made up of database schemas.</p> <p>Each storage engine stores information differently.</p> <p>Common storage engines:</p> <p>MYISAM – stores data in .FRM, .MYD and .MYI files.</p> <p>InnoDB – stores data in a common tablespace or individual tablespaces per table.</p> <p>Binary logs are used for point-in-time recovery</p>	<p>Uses tablespaces for system metadata, user data and indexes. Common tablespaces include:</p> <p>SYSTEM</p> <p>SYSAUX</p> <p>USER DATA</p> <p>USER INDEXES</p> <p>TEMPORARY</p> <p>UNDO</p> <p>Redo and archive log files are used for point in time recovery.</p>
Tables	Tables use storage engines. Each storage engine provides different characteristics and behavior.	A few tables with tons of features.
Partitioning	Free, basic features	\$\$\$ with lots of options
Replication	Free, relatively easy to setup and manage. Basic features but works great. Great horizontal scalability.	\$\$\$, lots of features and options. Much higher complexity with a lot of features. Allows a lot of data filtering and manipulation.
Transactions	InnoDB and upcoming Falcon and Maria storage engines	Regular and Index only tables support transactions.
Backup/Recovery	<p>No online backup built-in.</p> <p>Replication</p> <p>OS Snapshots</p> <p>InnoDB Hot Backup</p>	Recovery Manager (RMAN) supports hot backups and runs as a separate central repository for multiple Oracle database servers.
Export/Import	Easy, very basic.	More features.
Data Dictionary (catalog)	Information schema and mysql database schemas offer basic metadata.	Data dictionary offers lots of detailed information for tuning. Oracle starting to charge for use of new metadata structures.
Management/Monitoring	<p>\$, MySQL Enterprise Monitor offers basic functionality.</p> <p>Additional open source solutions.</p> <p>May also use admin scripts.</p>	<p>\$\$\$\$, Grid Control offers lots of functionality.</p> <p>Lots of 3rd party options such as BMC, Quest, Embarcadero and CA.</p>
Storage	Each storage engine uses different storage. Varies from individual files to tablespaces.	Tables managed in tablespaces. ASM offers striping and mirroring using cheap fast disks.
Stored Procedures	Very basic features, runs interpreted in session threads. Limited scalability.	Advanced features, runs interpreted or compiled. Lots of built in packages add

		significant functionality. Extremely scalable.
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MySQL Vs PostgreSQL

Name	MySQL	PostgreSQL
Description	Widely used open source RDBMS	Based on the object relational DBMS Postgres
Database model	Relational DBMS	Relational DBMS
Website	www.mysql.com	www.postgresql.org
Technical documentation	dev.mysql.com/doc	www.postgresql.org/docs/manuals
Developer	Oracle	PostgreSQL Global Development Group
Initial release	1995	1989
Current release	5.7.13, June 2016	9.5.3, May 2016
License	Open Source	Open Source
Database as a Service (DBaaS)	no	no
Implementation language	C and C++	C
Server operating systems	FreeBSD Linux OS X Solaris Windows	FreeBSD HP-UX Linux NetBSD OpenBSD OS X Solaris Unix Windows
Data scheme	yes	yes
Typing	yes	yes
XML support	yes	no
Secondary indexes	yes	yes
SQL	yes	yes
APIs and other access methods	ADO.NET JDBC ODBC	native C library streaming API for large objects ADO.NET JDBC ODBC
Supported programming languages	C C# C++	.Net C C++

	D Eiffel Erlang Haskell Java Objective-C OCaml Perl PHP Python Ruby Scheme Tcl	Java Perl Python Tcl
Server-side scripts	yes	user defined functions
Triggers	yes	yes
Partitioning methods	horizontal partitioning, sharding with MySQL Cluster or MySQL Fabric	no, but can be realized using table inheritance
Replication methods	Master-master replication Master-slave replication	Master-slave replication
MapReduce	no	no
Consistency concepts		Immediate Consistency
Foreign keys	yes	yes
Transaction concepts	ACID	ACID
Concurrency	yes	yes
Durability	yes	yes
In-memory capabilities	yes	no
User concepts	Users with fine-grained authorization concept	fine grained access rights according to SQL-standard

MongoDB vs Hadoop vs MySQL vs Oracle vs PostgreSQL

Name	MongoDB	Hadoop	MySQL	Oracle	PostgreSQL
Description	One of the most popular document stores	A distributed file system that provides high-throughput access to application data.	Widely used open source RDBMS	Widely used RDBMS	Based on the object relational DBMS Postgres
Database model	Document store	HDFS	Relational DBMS	Relational DBMS	Relational DBMS

Website	www.mongodb.org	http://hadoop.apache.org/	www.mysql.com	www.oracle.com/us/products/database	www.postgresql.org
Technical documentation	docs.mongodb.org/manual	http://hadoop.apache.org/docs/current/	dev.mysql.com/doc	docs.oracle.com/en/database/database.html	www.postgresql.org/docs/manuals
Developer	MongoDB, Inc	Apache Software Foundation	Oracle	Oracle	PostgreSQL Global Development Group
Current Release	3.2.6, March 2016	2.7.2, January 2016	5.7.12, April 2016	12 Release 1 (12.1.0.2), July 2014	9.5.3, May 2016
License	Open Source	Open Source	Open Source	Commercial	Open Source
Implementation language	C++	Java	C and C++	C and C++	C
Server Operating Systems	Linux OS X Solaris Windows	Linux Windows BSD Mac OS/X OpenSolaris	FreeBSD Linux OS X Solaris Windows	AIX HP-UX Linux OS X Solaris Windows z/OS	FreeBSD HP-UX Linux NetBSD OpenBSD OS X Solaris Unix Windows
Data Scheme	Schema-free	Schema on-read	yes	yes	yes
Secondary indexes	yes		yes	yes	yes
APIs and other access methods	proprietary protocol using JSON	Cascading	ADO.NET JDBC ODBC	ODP.NET Oracle Call Interface (OCI) JDBC ODBC	Native C library streaming API for large objects ADO.NET JDBC ODBC

Supported Programming Languages	Actionscript C C# C++ Clojure ColdFusion D Dart Delphi Erlang Go Groovy Haskell Java JavaScript Lisp Lua MatLab Perl PHP PowerShell Prolog Python R Ruby Scala Smalltalk	C C# C++ Hive Java Jaql Pig SQL	Ada C C# C++ D Eiffel Erlang Haskell Java Objective-C OCaml Perl PHP Python Ruby Scheme Tcl	C C# C++ Clojure Cobol Eiffel Erlang Fortran Groovy Haskell Java JavaScript Lisp Objective C OCaml Perl PHP Python R Ruby Scala Tcl Visual Basic	.Net C C++ Java Perl Python Tcl
Server-side scripts	JavaScript		yes	PL/SQL	user defined functions
Triggers	no		yes	yes	yes
Partitioning Methods	Sharding		horizontal partitioning, sharding with MySQL Cluster or MySQL Fabric	horizontal partitioning	no, but can be realized using table inheritance
Replication Methods	Master-slave replication		Master-master replication Master-slave	Master-master replication Master-slave replication	Master-slave replication

			ve replication		
MapReduce	yes	yes	no	no	no
Consistency Concepts	Eventual Consistency Immediate Consistency			Immediate Consistency	Immediate Consistency
Foreign Keys	no		yes	yes	yes
Transaction Concepts	no		ACID	ACID	ACID
In-memory Capabilities	yes		yes	yes	no
User Concepts	Access rights for users and roles		Users with fine-grained authorization concept	fine grained access rights according to SQL-standard	fine grained access rights according to SQL-standard

RDBMS Vs NOSQL Questions

- 1) What is the nature of the project?
 - o New development Any of the database can be selected
 - o Modernization or migration Current DB will be Ranked higher

Ask subsequent question what is your source DB?
- 2) Data uniform structure?
 - o Yes RDBMS
 - o No NoSQL
- 3) Is the system transactional / data model relational in nature?
 - o Yes RDBMS
 - o No NoSQL
- 4) Is the system ACID (atomicity, consistency, isolation, and durability) compliant?
 - o Yes RDBMS
 - o No NoSQL
- 5) Small items inserted frequently or few large items inserted infrequently?
 - o Small RDBMS
 - o Large NoSQL

- 6) What are the availability requirements?
 - ☐ 98%
 - ☐ 99%
 - ☐ 99.9%
 - ☐ 99.99%
 - ☐ 99.999%
- 7) What are the acceptable data loss requirements (Support for Point in Time recovery)?
 - ☐ 24 hours
 - ☐ 8 hours
 - ☐ 1 hour
 - ☐ 15 minutes
- 8) How many peak "read" operations do you anticipate the system to support?
 - ☐ High
 - ☐ Medium
 - ☐ Low
- 9) How many peak "write" operations do you anticipate the system to support?
 - ☐ High
 - ☐ Medium
 - ☐ Low
- 10) Does the system integrate with external systems?
 - ☐ Yes
 - ☐ No
- 11) Does the system store and/or manipulate large documents?
 - ☐ Yes
 - ☐ No
- 12) What's the level of commercial support & community knowledge required?
 - ☐ High
 - ☐ Medium
 - ☐ Low

RDBMS Selection Questions

- 1) What is the size of the database?
 - ☐ 0 to 1 GB Rank MySQL, PostgreSQL and Oracle same
 - ☐ 1 GB to 10 GB Rank MySQL, PostgreSQL and Oracle same
 - ☐ 10 GB to 100 GB Rank MySQL, PostgreSQL same and Oracle higher
 - ☐ 100 GB to 1 TB Rank MySQL, PostgreSQL Zero and Oracle higher
 - ☐ Over 1TB Rank MySQL, PostgreSQL Zero and Oracle higher

If large database – Enterprise level (Oracle) selection
- 2) Distributed data (Multi region data)?

- Single computer? Rank MySQL, PostgreSQL and Oracle same
 - Across geographical area? Rank Oracle higher
- 3) Is the system internal or public-facing?
- Internal Rank Oracle higher
 - Public-facing Rank MySQL, PostgreSQL higher or same with Oracle
- 4) Require data warehousing, decision support systems and/or BI?
- High (Data Analytics) Rank Oracle higher
 - Medium (Complex Joins) Rank same
 - Low (Simple computation) Rank MySQL, PostgreSQL higher
 - None (Data In/Out) Rank MySQL, PostgreSQL higher
- 5) Does the system store and/or manipulate spatial data?
- Yes
 - No
- 6) Does the system support free-text searches?
- Yes
 - No
- 7) Support for declarative index creation to enhance ease of use
- 8) Support for querying data by secondary indexes to provide flexible data access
- Yes
 - No
- 9) Native support for compound indexes
- Yes
 - No
- 10) Support for enforcing unique constraints within the database
- Yes
 - No
- 11) In memory capabilities required
- Yes
 - No
- 12) JSON Support required
- Yes
 - No

**** Evaluate current GSA application(s) and gather list of database specific features used in applications (Example Full **text search ifilter support**)**

Common Question for RDBMS or NoSQL Selection

- 1) Data ingestion size
- High (We will define what high means in numbers in future)

- ☐ Medium
 - ☐ Low
- 2) How address scalability
 - ☐ vertically (add resources to server)
 - ☐ horizontally (distributed DB, sharding)
- 3) Need for encryption of data
 - ☐ Yes
 - ☐ No
- 4) Support for SSL encryption of data over the network
 - ☐ Yes
 - ☐ No
- 5) Support for password elimination by using Kerberos authentication
 - ☐ Yes
 - ☐ No
- 6) Support for auditing operations against the database
 - ☐ Yes
 - ☐ No
- 7) Support for restricting access to individual fields of a record
 - ☐ Yes
 - ☐ No
- 8) Support for cross region replication of a single database, with active/active data centers
 - ☐ Yes
 - ☐ No
- 9) Need of ability to accept writes in the event of any node failing (i.e. multimaster)
 - ☐ Yes
 - ☐ No
- 10) Support for adhoc queries against the database in the application
 - ☐ Yes
 - ☐ No
- 11) Need of support for PKI by using x.509 certificates in the application
 - ☐ Yes

- o No

12) Need of support for self-healing recovery (Automatic Failover) that eliminates manual intervention to restore service

- o Yes
- o No

7 References

MySQL

MySQL is the most popular one of all the large-scale database servers. It is a feature rich, open-source product that powers a lot of web-sites and applications online. Getting started with MySQL is relatively easy and developers have access to a massive array of information regarding the database on the internet.

Advantages of MySQL

- **Easy to work with:**

MySQL can be installed very easily. Third-party tools, including visual ones (i.e. GUIs) make it extremely simple to get started with the database.

- **Feature rich:**

MySQL supports a lot of the SQL functionality that is expected from a RDBMS -- either directly or indirectly.

- **Secure:**

A lot of security features, some rather advanced, are built in MySQL.

- **Scalable and powerful:**

MySQL can handle *a lot* of data and furthermore it can be used "at scale", if needed be.

- **Speedy:**

Giving up some standards allows MySQL to work very efficiently and cut corners, thus providing speed gains.

Disadvantages of MySQL

- **Known limitations:**

By design, MySQL does not intend to do everything and it comes with functional limitations that some state-of-the-art applications might require.

- **Reliability issues:**

The way certain functionality gets handled with MySQL (e.g. references, transactions, auditing etc.) renders it a little-less reliable compared to some other RDBMSs.

- **Stagnated development:**

Although MySQL is still technical an open-source product, there are complaints regarding the development process since its acquisition. However, it should be noted that there are some MySQL-based, fully-integrated databases that add value on top of the standard MySQL installations (e.g. MariaDB).

When To Use MySQL

- **Distributed operations:**

When you need more than what SQLite can offer, including MySQL to your deployment stack, just like any stand-alone database server, brings a lot of operational freedom together with some advanced features.

- **High security:**

MySQL's security features provide reliable protection for data-access (and use) in a simple way.

- **Web-sites and web-applications:**

A great majority of web-sites (and web-applications) can simply work on MySQL despite the constraints. This flexible and somewhat scalable tool is easy to use and easy to manage -- which proves very helpful in the long run.

- **Custom solutions:**

If you are working on a highly specific and extremely custom solution, MySQL can tag along easily and go by your rules thanks to its rich configuration settings and operation modes.

When Not To Use MySQL

- **SQL compliance:**

Since MySQL does not [try to] implement the full SQL standard, this tool is not completely SQL compliant. If you might need integration with such RDBMSs, switching from MySQL will not be easy.

- **Concurrency:**

Even though MySQL and some storage engines perform really well with *read* operations, concurrent *read-writes* can be problematic.

- **Lack of features:**

Again, depending on the choice of the database-engine, MySQL can lack certain features, such as the full-text search.

PostgreSQL

PostgreSQL is a powerful, open source object-relational database system. It runs on all major operating systems, including Linux, UNIX (AIX, BSD, HP-UX, SGI IRIX, Mac OS X, Solaris, Tru64), and Windows. It is fully ACID compliant, has full support for foreign keys, joins, views, triggers, and stored procedures (in multiple languages). It includes most SQL data types, including INTEGER, NUMERIC, BOOLEAN, CHAR, VARCHAR, DATE, INTERVAL, and TIMESTAMP. It also supports storage of binary large objects, including pictures, sounds, or video. PostgreSQL runs stored procedures in more than a dozen programming languages, including Java, Perl, Python, Ruby, Tcl, C/C++, and its own PL/pgSQL, which is similar to Oracle's PL/SQL. An enterprise class database, PostgreSQL boasts sophisticated features such as Multi-Version Concurrency Control (MVCC), point in time recovery, tablespaces, asynchronous replication, nested transactions (savepoints), online/hot backups, a sophisticated query planner/optimizer, and write ahead logging for fault tolerance. It supports international character sets, multibyte character encodings, Unicode, and it is locale-aware for sorting, case-sensitivity, and formatting. It is highly scalable both in the sheer quantity of data it can manage and in the number of concurrent users it can accommodate. Best of all, PostgreSQL's source code is available under a liberal open source license.

PostgreSQL is *the* advanced, open-source [object]-relational database management system which has the main goal of being standards-compliant and extensible. PostgreSQL, or Postgres, tries to adopt the ANSI/ISO SQL standards together with the revisions.

Compared to other RDBMSs, PostgreSQL differs itself with its support for highly required and integral object-oriented and/or relational database functionality, such as the complete support for reliable transactions, i.e. Atomicity, Consistency, Isolation, Durability (ACID).

Due to the powerful underlying technology, Postgres is extremely capable of handling many tasks very efficiently. Support for concurrency is achieved without read locks thanks to the implementation of Multiversion Concurrency Control (MVCC), which also ensures the ACID compliance.

PostgreSQL is highly programmable, and therefore extendible, with custom procedures that are called "stored procedures". These functions can be created to simplify the execution of repeated, complex and often required database operations.

Advantages of PostgreSQL

- **An open-source SQL standard compliant RDBMS:**

PostgreSQL is open-source and free, yet a very powerful relational database management system.

- **Strong community:**

PostgreSQL is supported by a devoted and experienced community which can be accessed through knowledge-bases and Q&A sites 24/7 for free.

- **Strong third-party support:**

Regardless of the extremely advanced features, PostgreSQL is adorned with many great and open-source third-party tools for designing, managing and using the management system.

- **Extensible:**

It is possible to extend PostgreSQL programmatically with stored procedures, like an advanced RDBMS should be.

- **Objective:**

PostgreSQL is not just a relational database management system but an objective one - with support for nesting, and more.

- **Immunity to over-deployment**

Over-deployment is what some proprietary databases regard as their top license compliance problem. With PostgreSQL, there is no licensing agreements breach, as there is no associated licensing cost for the software.

This has several additional advantages:

- More profitable business models with wide-scale deployment.
- No possibility of being audited for license compliance at any stage.
- Flexibility to do concept research and trial deployments without needing to include additional licensing costs.

- **Significant saving on staffing costs**

The software has been designed and created to have much lower maintenance and tuning requirements than the leading proprietary databases, yet still retain all of the features, stability, and performance.

In addition to this, progressql training programs are generally regarded as being far more cost effective, manageable, and practical than that of the other leading proprietary database vendors.

- **Reliability and stability**

Unlike many proprietary databases, many companies report that PostgreSQL has never, ever crashed in several years of high activity operations.

- **Extensible**

Source code is available to everyone at no charge. This gives the ability to customize or extend PostgreSQL in any way with a minimum of effort, and with no attached costs.

- **Cross platform**

PostgreSQL is available for almost every brand of UNIX (34 platforms with the latest stable release), and Windows compatibility is available via the Cygwin framework. Native Windows compatibility is also available with version 8.0 and above.

- **Designed for high volume environments**

PostgreSQL uses a multiple row data storage strategy called MVCC to make it extremely responsive in high volume environments.

- **GUI database design and administration tools**

There are many high-quality GUI Tools available for PostgreSQL from both open source developers and commercial providers.

Disadvantages of PostgreSQL

- **Performance:**

For simple *read*-heavy operations, PostgreSQL can be an over-kill and might appear less performant than the counterparts, such as MySQL.

- **Popularity:**

Given the nature of this tool, it lacks behind in terms of popularity, despite the very large amount of deployments - which might affect how easy it might be possible to get support.

- **Hosting:**

Due to above mentioned factors, it is harder to come by hosts or service providers that offer managed PostgreSQL instances.

When To Use PostgreSQL

- **Data integrity:**

When reliability and data integrity are an absolute necessity without excuses, PostgreSQL is the better choice.

- **Complex, custom procedures:**

If you require your database to perform custom procedures, PostgreSQL, being extensible, is the better choice.

- **Integration:**

In the future, if there is a chance of necessity arising for migrating the entire database system to a propriety (e.g. Oracle) solution, PostgreSQL will be the most compliant and easy to handle base for the switch.

- **Complex designs:**

Compared to other open-source and free RDBMS implementations, for complex database designs, PostgreSQL offers the most in terms of functionality and possibilities without giving up on other valuable assets.

When Not To Use PostgreSQL

- **Speed:**

If all you require is fast *read* operations, PostgreSQL is not the tool to go for.

- **Simple set ups:**

Unless you require absolute data integrity, ACID compliance or complex designs, PostgreSQL can be an over-kill for simple set-ups.

- **Replication:**

Unless you are willing to spend the time, energy and resources, achieving replication with MySQL might be simpler for those who lack the database and system administration experience.

Source:

<https://www.digitalocean.com/community/tutorials/sqlite-vs-mysql-vs-postgresql-a-comparison-of-relational-database-management-systems>