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Oracle Rdb Product Family Update

Kevin Duffy and Ian Smith

Oracle Database on OpenVMS and Oracle Rdb Engineering

August 2024

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Agenda – Oracle Rdb Product Family Update

- Support Dates
- Recent Releases
- What's Under Development
- Oracle Rdb and OpenVMS in the Oracle Cloud
- Roadmap

What Products Make up The Rdb Product Family?

- Oracle Rdb Server
- Oracle CODASYL DBMS
- Oracle Trace
- Oracle CDD/Repository
- Oracle JDBC for Rdb
- Oracle Rdb Developer Tools for Visual Studio
- Oracle Rdb Connectivity Manager
- Oracle Rdb Extension for SQL Developer
- Oracle Rdb Extension for Oracle Enterprise Manager
- Oracle ODBC Driver for Rdb
- Oracle SQL/Services & OCI Services for Oracle Rdb
- Oracle Replication Option

Rdb Product Family Lifetime Support Dates

Oracle Rdb Database Releases

Release	GA Date	Premier Support Ends	Extended Support Ends	Sustaining Support Ends
7.0	Oct 1996	Aug 2007	Aug 2009	Indefinite
7.1	Jul 2001	Dec 2007	Dec 2010	Indefinite
7.2	Jan 2006	Jul 2015	Jul 2017	Indefinite
7.3	Mar 2011	Sep 2020	Sep 2023	Indefinite
7.4	Aug 2020	Dec 2025	Not Available	Indefinite

See: http://www.oracle.com/us/support/library/lifetime-support-technology-069183.pdf

Rdb Product Family Lifetime Support Dates

Oracle CODASYL DBMS Database Release

Release	GA Date	Premier Support Ends	Extended Support Ends	Sustaining Support Ends
7.0	Oct 1996	Aug 2007	Aug 2009	Indefinite
7.1	Jul 2001	Dec 2007	Dec 2010	Indefinite
7.2	Jan 2006	Jul 2015	Jul 2017	Indefinite
7.3	Mar 2011	Sep 2020	Sep 2023	Indefinite
7.4	Nov 2021	Dec 2025	Not Available	Indefinite

See: http://www.oracle.com/us/support/library/lifetime-support-technology-069183.pdf

Rdb Product Family Releases Over the Past 2 Years

- **Rdb 7.4.1.3, June 2024**
- **CODASYL DBMS 7.4.1.3, June 2024**
- **Rdb 7.3.4.0, July 2023**
- **Rdb Developer Tools for Visual Studio 7.4.1.0, February 2023**
- **Rdb 7.4.1.2, August 2022**

Rdb 7.4.1.3, June 2024

- Available on My Oracle Support with the following patch set numbers:
  - I64: 36710977
  - Alpha: 36710989
- Software Errors fixed (partial list)
  - Row Cache Fails with CANTMAPSHMEM, NOSUCHSEC Error
  - Unexpected SQL-F-BUGCHK When Using SAVEPOINT Statement
  - Hash Join Behavior Mismatch
  - System Space Buffers not Freed Up After an RMU Close command
  - Unexpected Failure of RMU Convert Commit Command
  - CAST Function Converted Blank Strings to a Numeric Value

Oracle Rdb 7.4.1.3 Available for Download

Patch 36710977: ORACLE RDB RELEASE 7.4.1.3.0 (IMV)

Last Updated 07-Jun-2024 18:54 (1+ month ago)

Product	Oracle Rdb Server on OpenVMS
Release	Oracle Rdb Server 7.4.1.3.0
Platform	HP OpenVMS Itanium

Size	90.2 MB
Download Access	Software
Classification	General
Patch Tag	

Bugs Resolved by This Patch

List of bugs fixed is not available. Consult the Readme.

View Related Knowledge to this Patch

CODASYL DBMS 7.4.1.3, June 2024

- Available on My Oracle Support with the following patch set numbers:
  - I64: 36695838
  - Alpha: 36695849
- New Features (partial list)
  - The /LOCK_TIMEOUT Qualifier Can Now be Used With All DBO/RECLAIM Qualifiers
  - Updated Diagnostics for the DBO/MOVE_AREA Command
  - IEEE Floating Point Now Used For DBO/ANALYZE
- Problems Fixed (partial list)
  - Error From Disk Write Results in Hang
  - Unexpected COSI-F-EXQUOTA Error Using Buffer Objects
  - System Space Buffers not Freed Up After a DBO/CLOSE

Oracle CODASYL DBMS 7.4.1.3 Available for Download

Patch 36695838: ORACLE CODASYL DBMS 7.4.1.3.0 FOR OPENVMS ITANIUM

Last Updated 04-Jun-2024 19:24 (2+ months ago)

Product	Oracle CODASYL DBMS
Release	Oracle CODASYL DBMS 7.4.1.3.0
Platform	HP OpenVMS Itanium

Size	64.1 MB
Download Access	Software
Classification	General
Patch Tag	

Bugs Resolved by This Patch

List of bugs fixed is not available. Consult the Readme.

View Related Knowledge to this Patch

Rdb 7.3.4.0, July 2023

- Available on My Oracle Support with the following patch set numbers:
  - I64: 35586554
  - Alpha: 35586577
- Problems Fixed (partial list)
  - Long Running Delete Does Not Advance After-Image Journal Checkpoint
  - Long Running Query Blocks Other Queries
  - Unexpected Bugcheck When Using DROP STORAGE AREA CASCADE
  - Unexpected Bugcheck when query contained multiple COUNT(*) aggregate functions
  - Unexpected RMU/UNLOAD/AFTER Bugcheck at AIJEXT$QSORT_RELEASE_REC
  - Journal Backed Up While RMU/UNLOAD/AFTER/CONTINUOUS Extracting Journal

What’s Under Development

Next Rdb Versions

- Rdb and CODASYL DBMS X86 Beta kits
- CDD 7.4.1.0
- Trace 7.4.1.0
- Oracle Replication Option 7.4.1.0

Over to Ian Smith…

Porting Oracle Rdb and Friends to OpenVMS x86-64

Ian Smith

Credentials

- VMS X1.5
- Use PIP to copy
- RSX compatibility mode
- Hey you can use IF THEN ELSE in DCL
- ***I've been using VMS since 1978***
- What happened to F$LOGICAL?
- DBMS and DATATRIEVE consultant

- VAX-11 Rdb
- Rdb/VMS
- DEC Rdb now with SQL interface
- I've been using Rdb since 1984
- ***Started working in DEC's Rdb engineering 1989***
- Moved to Oracle… and Oracle Rdb Server
- 40 years later! Still Here!

Context

- Oracle Rdb product family
  - Oracle Rdb Server
  - Oracle CODASYL DBMS
  - Oracle Trace
  - Oracle CDD/Repository
  - Oracle Replication Option
  - Oracle JDBC for Rdb
  - etc.

- Large code base, written using several languages
- A single code source is used for all platforms with conditional compilation for platform specific features, or dependencies.
- Plus…

Context…

- Many tools used for building and testing
- Many tests for applications running Rdb, CDD, DBMS, etc
- Using FORTRAN, COBOL, C, C++, BASIC, Pascal, etc

Project started in 2018

- The Oracle Rdb team have a close working relationship with VMS engineering
- Face-to-face meetings with VSI Engineers and Management to talk though Oracle dependencies
- VSI described strategy for compilers and VMS releases

- Oracle highlighted our need for C++ (central backbone for SQL/Rdb)
- Oracle highlighted our need for the GEM back end for our own SQL$PRE and SQL$MOD compilers

Phase 0:

- No compilers yet but...
- VSI indicated that F$GETSYI("arch_name") would return "x86_64"
- So we could start adjusting DCL in the build system, and regression test system

- CROSS TOOLS environment coming
- We had done this before for Alpha, and IA64 porting
- So in that environment TOOLS$xxx references CROSS tools, libraries, header files, etc as appropriate
- Build used batch-queue as logical name pointing to a IA-64 system

Phase 0

- Review code for conditional compilation.
- `#if defined(alpha) || defined(ia64)`
- Need to be changed to include `defined(x86_64)` or simply
- `#if defined(OpenVMS)`

- Similar process for DCL procedures
- Look for LINK option dependencies
- Find tools that need to be re-compiled and/or written

Phase 1: CROSS Compilers

- Execute x86-64 build using CROSS compilers, linker, set command/object, message/object…
- Initially no OS for testing but we had to review new warnings and errors from compilers.

- Several modules included PIC PSECT attributes that were ignored by Alpha and IA-64
- X86-64 compilers displayed many new warnings. So we dealt with them…

- Some changes to the LINK options files were required (different names for libraries, etc)

Phase 1.5: Cross compilers and native SQLPRE/SQLMOD

- SQL$PRE and SQL$MOD x86 build
- **Special thanks to the VSI compiler team for helping us build SQL$PRE and SQL$MOD** that we needed to build our own products
- True VMS compilers that use the GEM backend for code generation
- Now on x86_64 it uses the GEM to LLVM backend

- A small number of changes were needed for SQL
- We use these compilers to build our own products
- V9.0 arrives so we can deploy images to run on our virtual systems

Phase 1.5: Cross compilers and native CXX (challenge)

- No CROSS CXX compiler.
- We were early adopters for clang CXX compiler
- We pushed the compile to x86_64 as a **clang** command line
- Initially no VMS exit status so needed to parse the output from submitted BATCH job to detected errors and warning

```
$  define /user /nolog –
          DECC$ARGV_PARSE_STYLE ENABLE
$  define /user /nolog –
          DECC$EFS_CASE_PRESERVE ENABLE
$
$  clang -g 'p1' 'p5' -o'p4’ –
          'optim_qual' 'pointer_size' 'other_quals'
```

Challenges: CXX

- Note: read the CXX release notes carefully
- *1.4 Differences Between C++ on OpenVMS I64 and OpenVMS x86-64*
- We share header files between C and CXX modules

- The datatypes 'long', 'size_t', 'nullptr_t', 'ptrdiff_t' are 64-bits wide on OpenVMS x86-64 but only 32-bits wide on OpenVMS I64
- The default size for pointers is 64-bits on OpenVMS x86-64 but only 32-bits on OpenVMS I64
- The compiler does not automatically upcase external names like all other OpenVMS compilers

Surprises

- During native builds we discovered that some obscure tools were written in **VAX SCAN**
- On Alpha these were run as VESTed images (_TV.EXE)
- On IA64 those VESTed images were AESTed (_AV_TV.EXE)
- So no chance of them being useful on x86-64

- OpenJDK arrived just in time
- Deployed a new JAVA based tool across all platforms to replace those tools

Technical Challenges: Memory Management

- LARGE MEMORY for GLOBAL BUFFERS
- This kernel level code uses PTE structures (Page Table Entries)
- x86-64 memory mapping is quite different from either Alpha or IA-64
- Expert level work from our team and the VMS kernel engineers

- BUFFER OBJECTS
- Aka SYS$IOPERFORM
- This performance feature required related expertise to complete
- Our close working relationship has been invaluable.

Phase 2: Full Native Builds

- Now running full native build
- Using CXX command interface to clang
- Amazing transition from clang to CXX. Kudos to the CXX team
- Tuning our products
  - Memory usage
  - Stack space
  - Resource usage

- 5 x86-64 nodes in our development cluster
- Nightly regression testing
- Adding new compiler updates from VSI into the mix (4 just this week!)

Deployment

- DBMS was first to run
- No CXX dependency
- Smaller code base

- Shares the same kernel (KODA)
  - Memory management
  - Buffering
  - Locking
  - Page I/O
  - File I/O
  - After Image journaling
  - Recovery unit journaling
  - Show statistics
  - Monitor process

DBMS “first boot”

```
$ dbo/show system
Oracle CODASYL DBMS X7.4-00 on node MJNOEL  9-AUG-2021 11:02:11.80
   - monitor started  9-AUG-2021 10:41:41.64 (uptime 0 00:20:30)
   - monitor log filename is "SYS$SYSROOT:[SYSEXE]DBMMON741.LOG;13"
   - no databases are accessed by this node

$ dbo/show statistics parts
%DBM-F-ROOTMAJVER, database format 73.0 is not compatible with software version 74.0

$ dbo/convert parts.roo
DKA100:[X86_FILES]PARTS.ROO;1, CONVERT/COMMIT Rootfile? [N]:Y

$ dbo/show statistics parts
…
```

Rdb “first boot”

```
$ rmu/show users
Oracle Rdb X7.4-00 on node RDB866 29-SEP-2022 16:39:47.26
    - monitor started 29-SEP-2022 16:28:56.54 (uptime 0 00:10:50)
    - monitor log filename is "SYS$SYSROOT:[SYSEXE]RDMMON741.LOG;1"


database $1$DGA170:[SMITHI.DATABASES.V74]MF_PERSONNEL_SQL.RDB;1
    - opened 29-SEP-2022 16:39:30.29 (elapsed 0 00:00:16)
    - 1 active database user on this node
      - 23E00591:1 - Ian Smith, SMITHI
- attached 29-SEP-2022 16:39:30.36 (elapsed 0 00:00:16)
- image RDB866$DKA0:[SYS0.SYSCOMMON.][SYSEXE]SQL$741.EXE;2
```

More examples

```
$ rmu/show version $1$DGA170:[SMITHI.DB.V74]MF_PERSONNEL_SQL.RDB
Executing RMU for Oracle Rdb X7.4-00 on OpenVMS x86_64 V9.2
Database $1$DGA170:[SMITHI.DB.V74]MF_PERSONNEL_SQL.RDB;1 requires version 7.4


$ dictionary operator
CDO> show version
Installed version of Oracle CDD/Repository is T7.4-200
CDO>
```

Final Notes

- On disk format unchanged
  - True for Rdb, DBMS and CDD
- Same after image format (and version) as V7.4.1.3

- Same version of Oracle Rdb Server on Alpha and Integrity can share the database
- Must be running the same release

…back to Kevin Duffy

Testing on x86

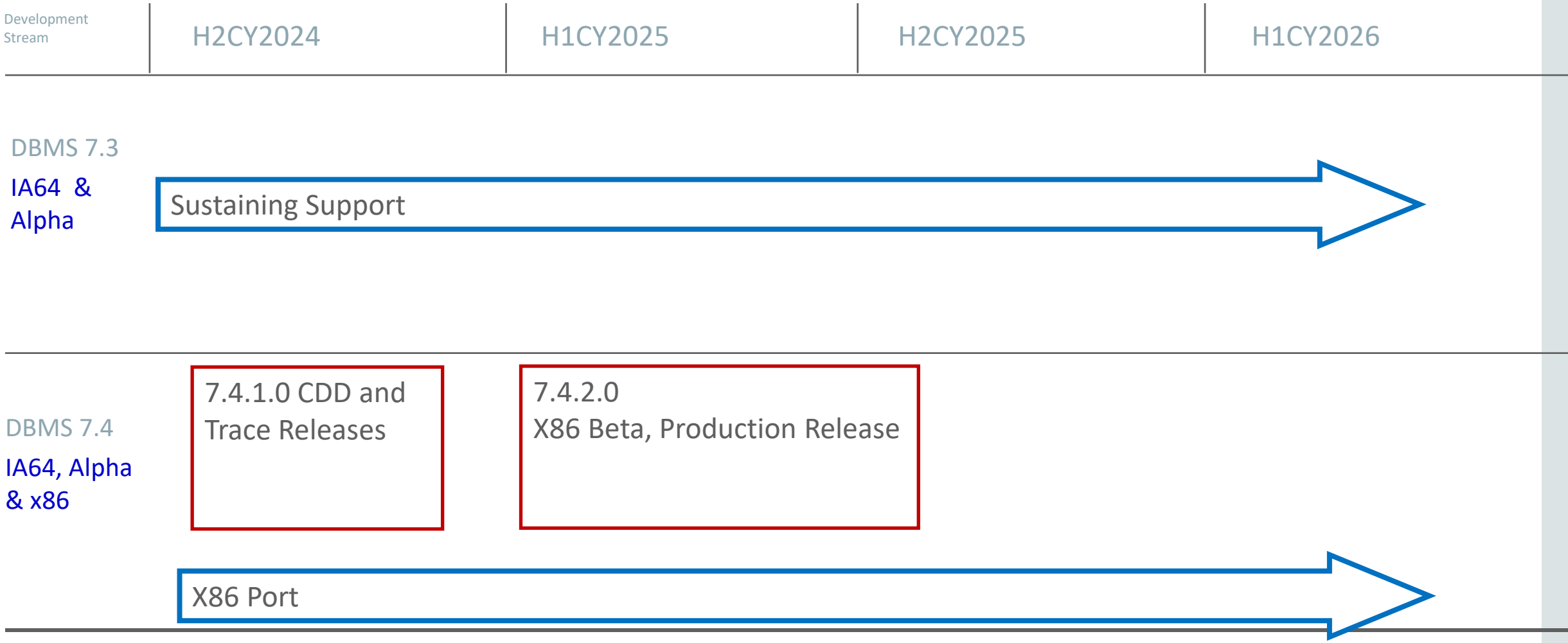
- 8,920 tests out of 9799 tests now running for a 91.2% success rate
  - 97% success of 9191 tests we are running
  - Of the 271 failures, some ACCVIOs which need to be investigated
  - Seeing differences in some query strategies
- 608 tests yet to be run
  - Replication Option, Trace, JDBC, .Net, SQL Services
- Runtime Testing Continues

Oracle Rdb in the Oracle Cloud

- The hypervisors in the Oracle Cloud use Oracle Enterprise Linux (OEL) KVM
- Oracle Rdb development is migrating our x86 development environment to OEL KVM
- Alpha customers can run in the Oracle Cloud using emulators
  - Stomasys or AVTWare
  - We've had an OpenVMS Oracle 10g customer running in the Oracle Cloud for several years

Oracle Rdb Roadmap

Oracle CODASYL DBMS Roadmap



Oracle Beta Programs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VMS Software

Application Services Overview (short version)

August 2024

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Agenda

- Introduction
- Application migration service
- Modernization
- Other application services
- Summary
- Questions

Application services

- A set of inter-related services to help customers get the most from their OpenVMS application environments…
  - Migration to OpenVMS x86-64
  - Integration
  - Modernization
  - Application maintenance and support
  - Reviews/workshops
  - …

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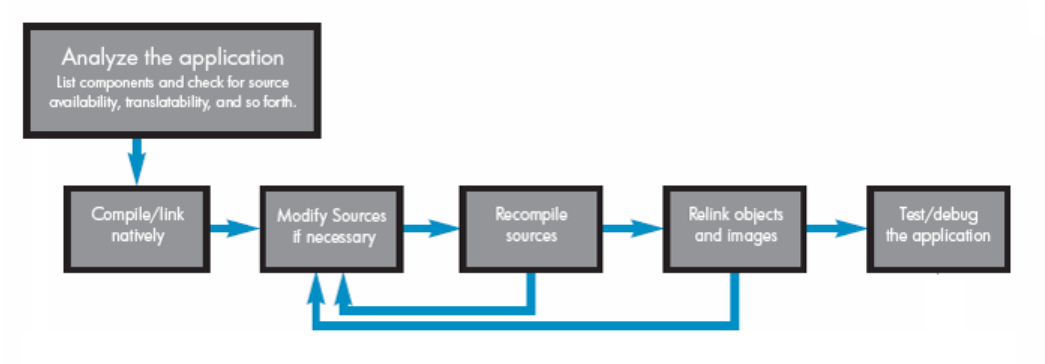
Migrating applications to x86-64

- Porting applications to OpenVMS x86-64 is easy... you just…
  - Recompile
  - Relink
  - Test and deploy

- Sure ☺
  - This will be true in a good number of cases, but certainly not for all
  - Sometimes a bit more work might be required…
  - Start thinking about it now!

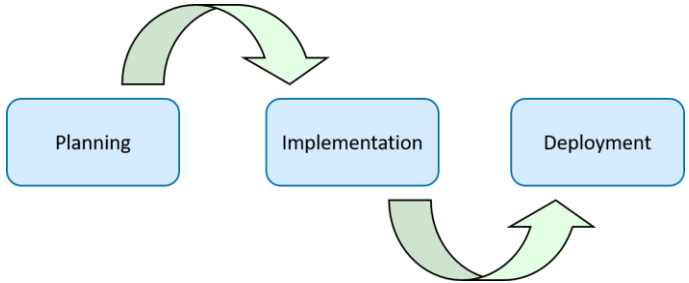


VSI Application Migration Service

- Comprehensive service to help customers move their applications from Alpha and Itanium to OpenVMS x86-64
- Phased approach to minimize risk and to deliver a successful outcome
  - Discovery phase (migration assessment)
  - Elaboration
  - Pilot
  - Migration
  - Deployment

- Tailored to address the unique requirements of each project
- Predicated on helping customers preserve and enhance their investment in OpenVMS technology

Migration projects to OpenVMS x86-64 will range in scale from a few days of effort to many months of effort, depending on scale, complexity, and various other factors. For smaller projects, a rigorous methodology is generally not required; however, for the larger projects a more formal and methodical approach will typically be essential to ensuring a successful result.



Case study (in progress)

A medium-complexity x86-64 migration project for an industrial customer. The core application running on OpenVMS comprises some 300,000 lines of complex code written in a variety of languages (C, C++, and Fortran), interacting with a Sybase database hosted on a Windows platform, with communication between the OpenVMS-based application and the Sybase database being achieved via the Sybase OpenClient API binary-translated from Alpha. In order to migrate the application to x86-64 and provide a supportable solution going forward the unsupported Sybase client API was replaced by the open-source FreeTDS API and an embedded SQL pre-processor was provided that could be used in conjunction with FreeTDS in place of the Sybase embedded SQL pre-processor.

- Custom application environment comprises roughly 300,000 lines of code
  - Mixture of C, C++ and Fortran code
  - Remote Sybase database
  - All database access via C++ with embedded SQL (some 1200 SQL statements)
  - Integrity environment using binary-translated Sybase client
  - Moderate use of OpenVMS system services and RTL functions
  - Numerous DCL scripts

- Relatively simple two-node cluster configuration
  - Few layered products
  - No database on OpenVMS, although some use of RMS for data storage
  - Interfaces to external systems

Case study – scope

Operating system and layered products:

- Design (hardware, VM configuration, ...)
- Planning of upgrade strategy
- Implementation
- Assistance during deployment
- Networking configured
- Migration of user accounts and application data
- Verification of clustering functionality
- Tuning
- As-built documentation
- ...

Hardware to run the virtualized OpenVMS x86-64 environment was discussed and confirmed (and purchased) prior to the start of the project. Virtualization software (VMware in this case) and version were likewise confirmed and agreed by VSI as being fit for purpose and constituting a supported configuration.

Case study – scope

Porting of custom application components:

- Review and analyse the application code and documentation
  - Check code for completeness
  - Analyse and validate build procedures
  - Identify issues (and solutions)
  - Document findings

- Port code
  - Establish development environment in VSI lab (if possible/permissible)
  - Establish build environment
  - Enhance pre-existing embedded SQL pre-processor
  - Compile and link code on x86-64
  - Address compilation and linking errors and warnings
  - Address identified code portability issues

- Testing
  - Joint effort
  - Basic testing done by VSI to validate that programs at least appear to run
  - Most testing done by customer (we don’t know their business)
  - Issues identified and resolved

Case study – deliverables

- Working OpenVMS x86-64 environment
- Ported application code
- Enhanced embedded SQL pre-processor and associated API components
- Release notes for the ported code
- As-built documentation for the new VSI OpenVMS x86-64 systems
- …

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Drivers for modernization

- Preservation of valued business assets

- Reduce risk and liability
  - Hardware availability and support issues (not such a problem with x86-64)
  - Software support issues
  - Availability of technical skills
  - Functional knowledge
  - Security and compliance

- Increase revenue
  - Reduce time-to-market for new products and services
  - Improve customer/user satisfaction
  - Enhance operational efficiency
  - Create new revenue streams

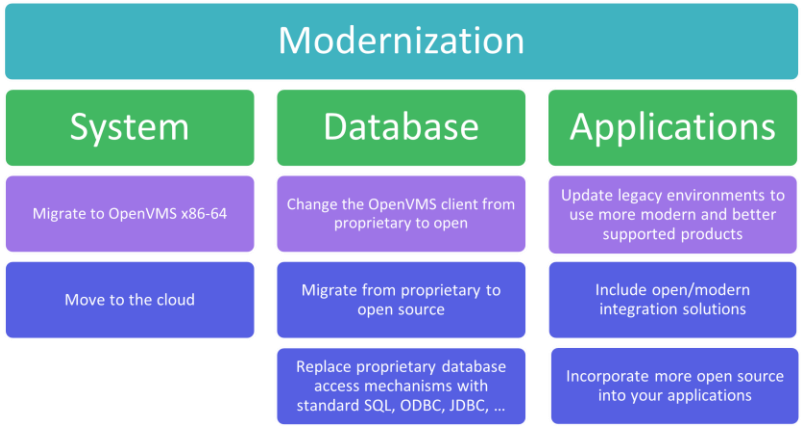
- Reduce costs, IT strategy, …
  - Licenses, maintenance, support, …
  - Labour costs
  - Infrastructure

- …

https://twitter.com/johncrickett/status/1746199424177463558

Common scenarios

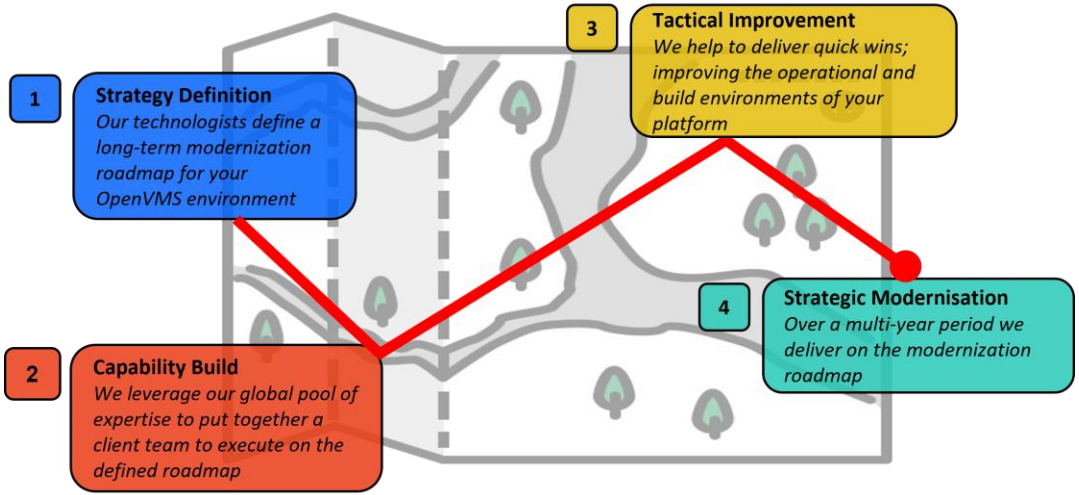
- Platform migrations (VAX to Alpha, Alpha to Integrity, Integrity to x86-64)
- Replace green screens with web interface or rich GUI
- Replace unsupported software components
- Integration
- Increased adoption of open-source technologies (support for open standards, reduce license costs, …)
- External authentication, single sign-on
- Database migrations
- Programming language conversions



How we can help

- Architectural workshops
- Assessment of your current environment
- Introduction of new technologies
- Platform migration

We follow a general approach to modernization that has worked well for many of our customers…



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Other application services

Integration:
Design and implementation of interfaces between OpenVMS application environments and other systems, leveraging both commercial and open-source technologies.

Application modernization:
Enhance and modernize OpenVMS-based legacy applications through th[illegible]duction of new software technologies (including replacement of unsupported third-party solutions).

Application maintenance and support:
Many OpenVMS users with large custom-written applications no longer have sufficient expertise in-house to maintain and support these applications and can find it difficult or expensive to find suitably skilled developers or service providers.

Application reviews:
Regardless of whether you are considering moving to OpenVMS on x86-64 in the future or staying with your existing VAX, Alpha, or Itanium platforms, it is important to have a top-to-bottom understanding of your application environment and what you can do with it.

VSI can provide cost-effective specialist application maintenance and support services for custom-written OpenVMS-based software applications and is able to tailor such services to meet your specific requirements.

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Summary

- VSI has deep technical knowledge and understanding of the OpenVMS environment
  - People, skills, resources
  - … and we also have a pretty good understanding of a few other things ☺
- VSI is uniquely positioned to deliver application services that…
  - Add business value
  - Protect your considerable investment in OpenVMS
  - Will help you save money and time
- VSI's application services portfolio covers...
  - Migration and porting
  - Integration
  - Modernization
  - Application maintenance and support
  - Development
  - Reviews and workshops
- Services are tailored to each unique customer situation

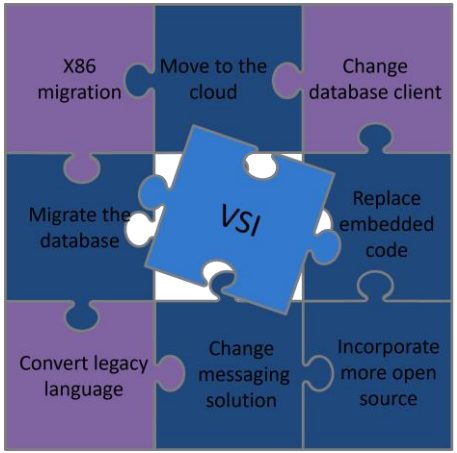
Summary

OpenVMS users tend to have four common technology challenges that drive broader business concerns…

1. Uncertain future of OpenVMS	***SOLVED:*** *VSI operating system roadmap including the x86-64 port provides a certain path forward for OpenVMS*
2. Lack of technology expertise	***SOLVED:*** *VSI has a global network of clients and resources in this technology domain*
3. Platform (inter)operability	***SOLVED:*** *Manage operational uncertainty using newly developed toolsets and solutions that provide a more transparent operational future*
4. Very old application software	***SOLVED:*** *Follow the lead of other OpenVMS users who, working with VSI, have successfully mapped, simplified, and modernized their application environments in a cost-effective and low-risk manner*

Summary

"VMS Software Inc. appreciates that there are many OpenVMS customers running large, complex, business-critical custom written software applications. Whilst these applications continue to serve the business very well, many of them now need to interoperate and exchange data with external systems and applications running on other operating systems. The options available are to replace the existing OpenVMS-based system or to modernize it in some way so that it can continue to operate in a modern heterogeneous computing environment."



... VSI is the central piece of the jigsaw!


Questions?