

Halcyon ONE™ High Level Design

Build: THUNDERBOLT

Abstract

This design document describes the purpose, construction and deployment of the Halcyon ONE™ product; part of the Halcyon Series™.

March 2015

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0 Document Metadata

The following rules for incrementing Halcyon document version numbers are to be adhered to:

- Version numbers of a document are digits. It is not permissible to have version indicators written in alphabets, or as alphanumeric indicators, such as 1a.
- All version numbers for documents will comprise two digits (preferable), or a maximum of three digits, using the following rules:
 - All documents start at version 0.01, incrementing by 0.01 to, for example, 0.02, 0.03, and so on.
 - A document at version 0.10 is written as "0.1"
 - A document at version 1.10 is written as "1.1"
 - A document at version 1.11 is written as "1.11".
- A change in the documents state or position in its lifecycle will support incrementing of the version number of the document.
- A minor change in the content of a design document is one that complies with the following criteria:
 - The change is a permanent change that requires transcription into the design document
 - The action of creating a single change or a collection of changes, within the design document **will not** change more than 10% of the content of the document.
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 - The action of creating a single change or a collection of changes, within the design document **will** change more than 10% of the content of the document.
- It is important to note the following with respect to version increments:
 - An increment value of 0.1 to the version number of a document (for example from 0.2 to 0.3) reflects a change in the milestone of a document and a major change in the content of the document by the author(s), (following a peer or TDA review or a project phase, such as proof-of-concept)
 - An increment value of 0.01 to the version number of a document (for example from 0.22 to 0.23) reflects a minor change in the content of a document by the author(s). These minor change version increments are permissible to assist authors in tracking their own minor changes in the documents during the documents lifecycle.

0.1 Document History

Author	Version	Date	Summary of iteration
Halcyon Technical Services	0.01	8th February 2015	Documentation draft completed
Halcyon Technical Services	0.2	17th February 2015	First draft of document complete and ready for peer review.
Halcyon Technical Services	0.3	20th February 2015	Second revision complete following first TDA review. Now ready for submission to TDA for second review
Halcyon Technical Services	0.4	1 st March 2015	Third revision complete following second TDA review. Now ready for submission to TDA for final review
Halcyon Technical Services	0.5	12th March 2015	Document approved by TDA
Halcyon Technical Services	0.9	13th March 2015	TDA finalise and file document in architectural document library
Halcyon Technical Services	1.0	13th March 2015	Document supporting solution in production environment

Table 1: Document History

0.2 Document Control

0.2.1 Document Status

The master for this document is held electronically and only signed copies are valid. An unsigned, printed document is not copy controlled and is to be used for INFORMATION ONLY, as it will not be automatically updated. It is therefore the responsibility of the reader to ascertain that it is a currently valid copy.

0.2.2 Review Procedure

Until fully reviewed and formally approved by Halcyon Solutions Group Ltd, this document forms the basis for discussion only. Halcyon is not bound by the contents and reserves the right to change its contents at any time prior to approval.

0.2.3 Change Control

This document is owned by Halcyon Technical Services; part of Halcyon Solutions Group Ltd. All requests for change must be directed to that office.

0.3 Acknowledgements

Hyper-V, Microsoft, Windows, System Centre 2012, Windows Server, Windows Explorer and Internet Explorer are registered trademarks of the Microsoft Corporation.

StarWind and StarWind VirtualSAN are registered trademarks of StarWind Software, Inc.

vSphere is a registered trademark of VMware, Inc.

0.4 References

No	Document Reference	Title	Version
1#	C_CBM	Halcyon Delivery Model	1.0
2#	HC_LLD_THUNDERBOLT	Halcyon ONE™ LLD_THUNDERBOLT	1.0

Table 2: References

0.5 Glossary of Terms

Term / Acronym	Expanded
ADDS	Active Directory Directory Services (Microsoft)
CESG	Communications-Electronics Security Group
CPU	Central Processing Unit
GB	Gigabyte
HLD	High Level Design
IOPS	Input/output [operations] Per-Second
iSCSI	Internet Small Computer System Interface
LLD	Low Level Design
MHz	Megahertz
MS	Microsoft
NTP	Network Time Protocol
PU	Privileged User
RAM	Random Access Memory
RDP	Remote Desktop Protocol (Microsoft)
SAN	Storage Area Network
SCCM	System Center Configuration Manager (Microsoft)
SQL	Structured Query Language
vCPU	Virtual CPU
VI	Virtual Infrastructure
VM	Virtual Machine
vRAM	Virtual RAM
WSUS	Windows Software Update Services (Microsoft)
PRE-SALES (Stage 1)	Part of the Halcyon Series™ Delivery Model (Ref 1#); first customer contact and used to determine basic engagement requirements
CAPTURE (Stage 2)	Part of the Halcyon Series™ Delivery Model (Ref 1#); used to capture detailed information about the customers IT estate and virtual infrastructure

Table 3: Glossary of Terms

1 Introduction

1.1 Document Lifecycle

This technical document has a single stage in its lifecycle; with respect to delivering a design methodology for the subject matter.

1.2 Intended Audiences

The intended audiences for this initial design document are:

- Halcyon Technical Services resources
- Resources from any third party involved in the review of this document
- Purchasing authorities who receive a copy of this design for retention in their internal records.

Although this document is a design document, its intention is a technical document that contains a minimal volume of overview text about technologies discussed within this solution.

The intended audience outlined above hence requires a pre-requisite basic understanding of the following examples of technologies and concepts (non-definitive list) discussed within this document:

- Delegated administration (Microsoft Active Directory Directory Services; organisational units and group policies)
- IT Configuration Management
- Networking
- SQL Server 2012
- StarWind VirtualSAN v8
- System Centre 2012
- Windows Server 2012
- Virtualisation.

1.3 Context

Halcyon Technical Services aims to provide the audience (listed above) with a quick set of technical resources akin to the construct of the product/service being defined.

Detailed technical build and configuration information can be found in the supporting Halcyon ONE™ Low Level design ([Ref 2#](#)).

A full list of Halcyon Technical Services material can be obtained by contacting the same office.

1.4 Document Function

This design document is a static document with a lifespan linked to the Halcyon ONE™ product defined within. This document hence supports the following functions:

- To represent one authoritative source of design information relating to the purpose, construction and deployment of Halcyon ONE™.

1.5 Document Scope

This document details the business drivers for Halcyon ONE™, its functional and non-functional design, and leads to its build and deployment.

1.5.1 In-Scope

The following elements of the Halcyon ONE™ product are considered in-scope of the solution:

- Design overview for Halcyon ONE™
- Step-by-step deployment of Halcyon ONE™
- External technical reference from the software vendor.

1.5.2 Out of Scope

The following elements are considered out of scope of Halcyon ONE™:

- Post-deployment training and support
- Other products in the Halcyon Series™ range
- Wider products and services offered by Halcyon Solutions Group Ltd.

1.6 Document Structure

This section describes the structure of this document, and the principles behind the structure.

The objective of this document is to facilitate the transfer of knowledge to the reader.

The main body of this document will hence detail the following for each design component:

- The objective of the design component
- A brief overview of the design component
- A listing of the design variables that must be addressed to create design component
- The approach employed to address the design variables
- The design decision(s) for key variables.

2 Halcyon ONE™ Overview

2.1 Business Value

Halcyon has many years of experience in working in large complex IT environments and one of its key streams has been the creation of management and monitoring solutions that aim to simplify support models without impeding the business's ability to be innovative and scalable. Within the last five years, Halcyon has also spent a lot of time working with government clients who have demonstrated an additional need for advancing levels of IT security to be 'baked-in' to such solutions.

The advent of cloud computing for both government and commercial service providers has proved highly yielding, but at the same time, it has highlighted some common deficiencies; born out of historical back office thinking. Even today, a staggering 80% of IT Change Management systems are manually orchestrated by human operators and disjointed from direct electronic interaction with the live systems they govern. Configuration Management systems still tend to be document-based, and revolve around storing design and configuration documents that need to be manually updated every time a change is made. These systems simply just don't scale with the modern data centre...and unnecessarily push up the total cost of ownership.

To explain this deficit in terms of a financial impact, consider the following scenario that Halcyon has witnessed time and time again. It starts with the final stage of a project; round about the time of service transition where the support community begin reviewing design and configuration documents. This is a painful time for the project which rarely produces comprehensive content on the first pass...let alone the content that is considered 100% accurate. The toing and froing can go on for many weeks all elevating project cost...but as it's been mandated, all parties fall into line. The solution eventually transitions into live, and now we have a library of very expensive paper that after day one, rarely gets updated. Changes come and go undocumented and now the live system is far from as-designed and nowhere near representative; rendering that expensive paper completely useless. One could simply say "well let's stop producing paper", but that approach doesn't fit with IT departments that look to re-use existing collateral to establish reliable design patters.

Sadly, the biggest aspect to the 'money pit' hasn't yet been identified. That comes when IT departments look to reaccredit their systems to a known good position in regular cycles; particularly common-place in government IT. All that hard work the project undertook in delivering a documented, 'clean' baseline system is long forgotten, and the ONLY now approach is to start the process of evaluation from scratch; always appreciating, the project also had to pick up this tab during delivery. In terms of financials, this process is not insignificant. It is also (typically) service affecting. Halcyon have captured the impact of running such evaluations which can take weeks to plan, weeks to undertake and generally demonstrate costs in tens of thousands of pounds.

For too long, IT Managers have simply accepted this wasteful approach as the *only* viable option.....and that is where Halcyon and the Halcyon Series™ looks to plug the demonstrable gap.

All IT businesses need to ensure core infrastructures and enabling services are deployed to a known good, secure and up to date. In the space of 'Platform' and 'Software-as-a-Service', cloud providers also need to ensure those same rich management functions cascade directly into their service offerings in order to defend their service levels, whilst they remain predominantly transparent to the client. Finally, management systems need to be highly dynamic for the modern data centre, and have the ability to respond to changing IT environments without the need for overburdening backend administration.

Historically, critical management services would be coupled with the corporate IT LAN and predominantly defined by the solutions they are intended to protect. But in today's cloud-ready world, the diversity of solutions requiring protection and the segregation that needs to be maintained between them means a different approach is required. Management services now need to be built for multi-tenancy from the offset, and maintain complete abstraction from the solutions they protect.

Halcyon has responded to this area of deficiency by creating the Halcyon Series™ product set. Halcyon ONE™ (the focus of this design) comprises of a number of Commercial-of-the-shelf (or COTS) products that combine to allow IT businesses to run complex IT infrastructures and service models without having to worry about building exponentially complicated backend management systems.

2.2 Design Vision

The design vision of the Halcyon ONE™ product is to:

- Simplify intelligent back office IT systems and integrate them with live systems
- Provide transparent, perpetual, IT compliance on back office and deployed systems
- Reduce TCO
- Provide an enterprise-class, on premise capability that is:
 - Fully encapsulated; therein agnostic to the IT estate into which it is deployed
 - Wholly virtualised; decoupling it from the customer-selected underlying hardware and ensuring its full product portability
 - Hypervisor-agnostic; providing immediate and future support assurance for the customers' preferred hypervisor
 - Self-sustaining; removing its dependency on existing IT corporate solutions like patching and antivirus
 - Built from only COTS-based products; therein providing the customer with the upfront assurance that they will NEVER be tied in to a protracted contract with Halcyon...or single stream providers.

- o Constructed with security at its core; endorsing that this isn't yet another solution where security is an overlay or after thought bolt-on
- o Highly scalable; to ensure it will suit the customers' needs for today, tomorrow and the unpredictable future
- o Built for dynamic IT estates out of the box; removing the need for overburdening administration efforts to add and remove protected systems manually
- o Rapidly deployable; reducing the upfront engagement costs for the customer
- o Built for the heterogeneous IT landscape; removing the need for system-specific point solutions.

2.3 Halcyon ONE™ Solution Context

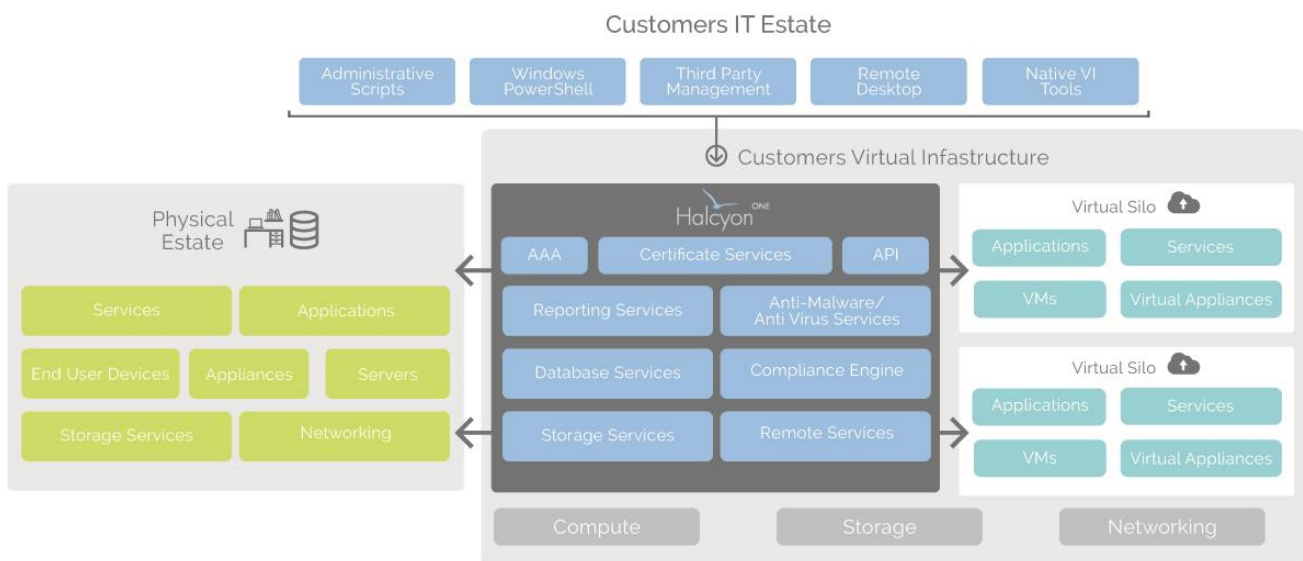


Figure 1: Solution Context Diagram of Halcyon ONE™

2.4 Key Components

The key components of the Halcyon ONE™ product comprise the following categories:

- A functional design set for the Halcyon ONE™ product
- A non-functional design set for the Halcyon ONE™ product.

2.4.1 Functional Components

Key Technical Design Decision 1#

★

Halcyon spend two years evaluating leading market products that aimed (or claimed) to tick the box of the requirements identified above. Microsoft has been dominant in the area of operating systems for many years...but has more recently been fighting for the top-spot in the management space with their System Center suit by extending their reach beyond Microsoft-only clients. Many software vendors are now either developing their APIs to integrate directly with System Center

sub-products, or writing 'integration packs' which act as logical interoperability constructs.

The breadth of its functionality linked with its heterogeneous IT integration has landed the Microsoft System Center suite as the Halcyon solution of choice.

The functional design for the Halcyon™ product series comprises the following key components:

- Microsoft Windows Server 2012 R2 Datacenter Edition – the base 64-bit operating system for the enabling virtual machines
- Microsoft System Center 2012 R2 – the comprehensive, unified management platform that enables easy and efficient management of IT environment, including virtual and physical server infrastructures and client devices, for both traditional data centres and private clouds.
- Microsoft SQL Server 2012 Enterprise Edition with SP2 – the database underpinning the core System Center applications suite
- StarWind VirtualSAN v8 – the virtualised iSCSI target storage provider for the database cluster.

2.4.2 Non-Functional Components

The non-functional design for the Halcyon™ product series comprises the following key components:

- Windows PowerShell – used in the automated build of the virtual machines and application stack.

3 Functional Design

Purpose: This chapter explains the design and layout of the Halcyon ONE™ product. It outlines its functional components and their use cases within the solution.

3.1 Solution Architecture

Halcyon ONE™ is designed as a feature-rich, self-contained set of virtual machines which mirrors the design constructs of a 'virtual appliance'; in that, once deployed, it is considered to have a limited number of internal and external interfaces, and maintains abstraction from the underpinning host infrastructure and management adjuncts.

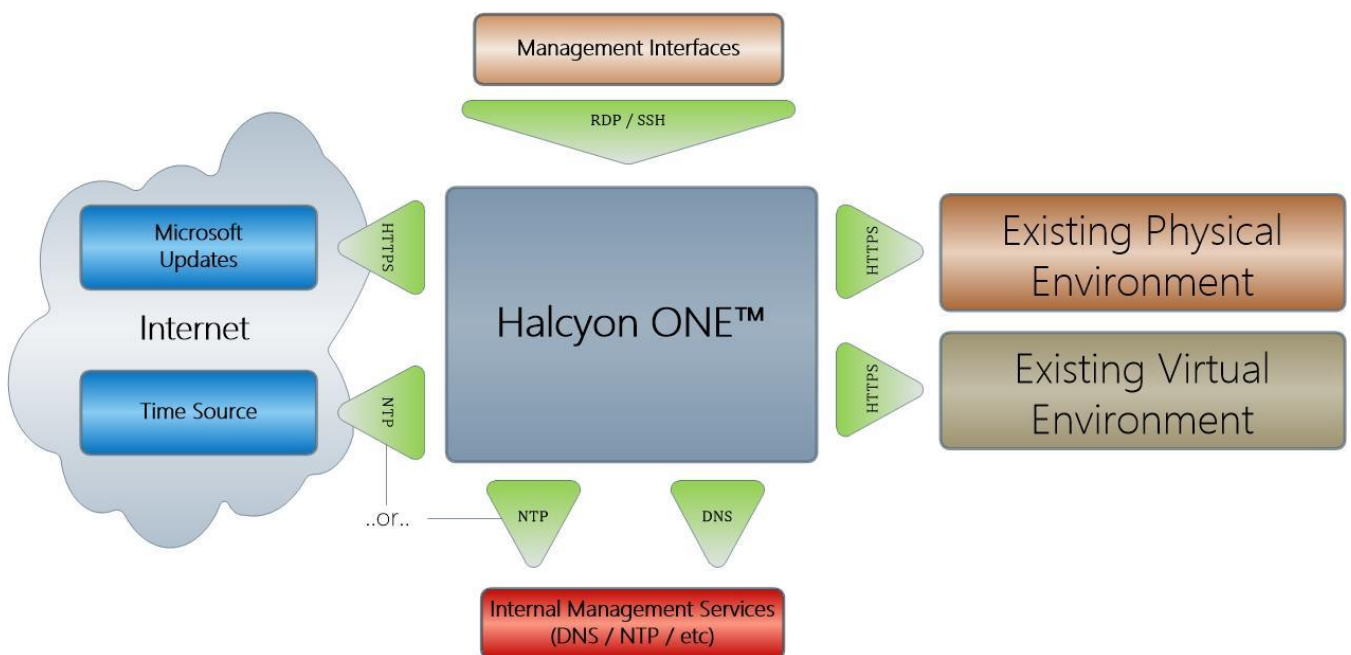


Figure 2: Solution Architecture

As you can see from Figure 2 above, Halcyon ONE™ has only two external (out-of-organisation) connections with everything else being internally based. It requires a connection to the Internet to pull Microsoft Updates (in order to keep itself perpetually up to date) and has an optional connection for pulling time synchronisation over NTP...this is only required if a source doesn't already exist in the customers' existing IT estate. It then has secure-only connections into target environments to sustain the desired compliance configuration. Lastly, it has a limited inbound interface to allowed remote desktop connectivity from the customers' administrators....and optional SSH for management service interoperability (where required).

3.2 Component Interoperability

Whilst Halcyon ONE™ provides a rich and expandable feature set, it has relatively small virtual infrastructure footprint. Only eight virtual machines are required as shown in Figure 3 below.

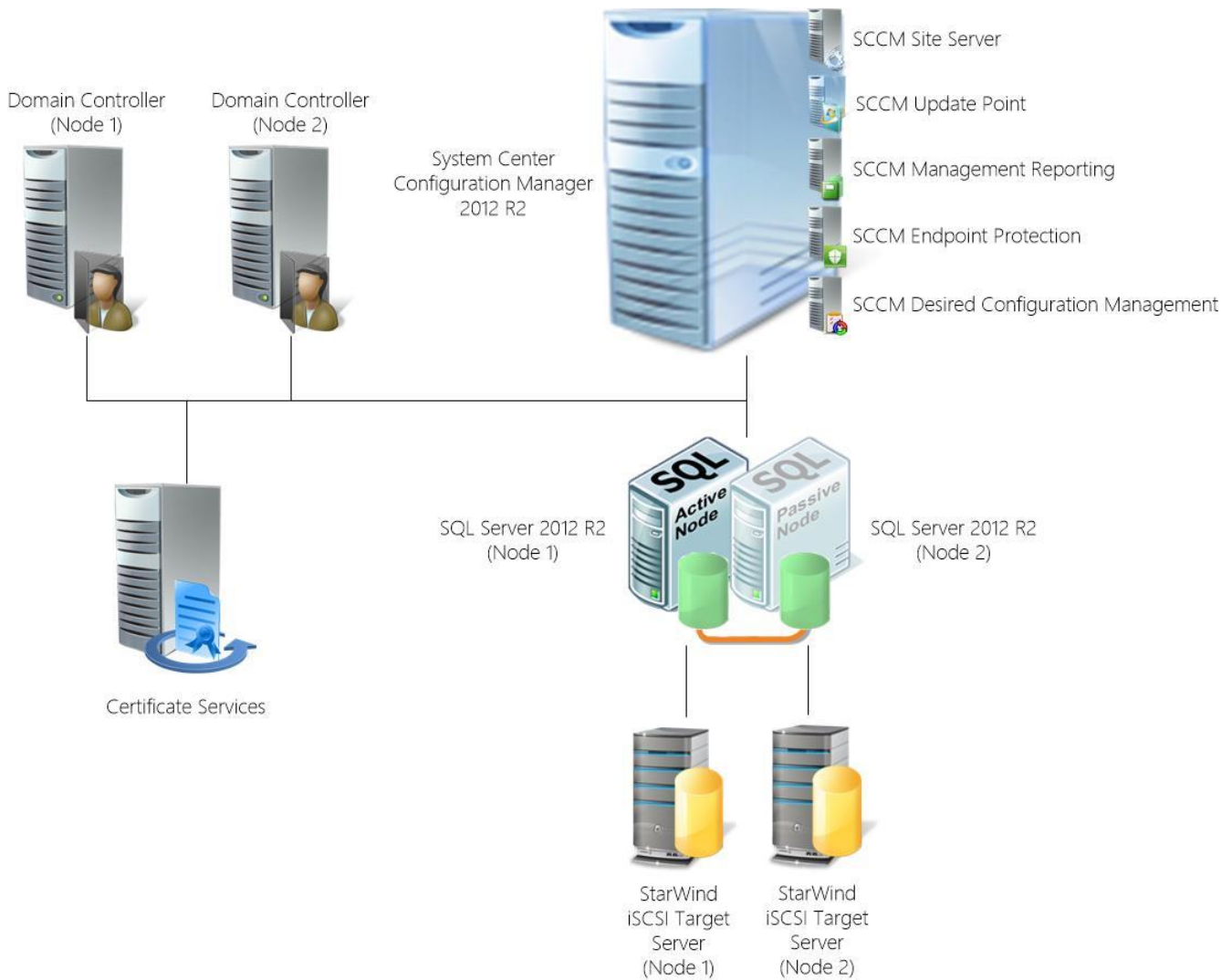


Figure 3: Component Interoperability

The System Center Configuration Management (SCCM) server is ultimately the ‘heart’ of the Halcyon ONE™ product and provides the engine through which IT compliance is define, directed, monitored and where necessary, enforced.

As part of the base automated build, Halcyon ONE™ is pre-populated with an extensive library of the latest Microsoft and CESG lockdown polices for Windows computer systems. Policies include best practice compliance for Windows members’ servers, Domain Controllers, Exchange Servers, SQL Servers, etc etc. The Halcyon ONE™ product is deployed to the customers’ IT estate and readied for interoperability with live systems in Stage 3# “BUILD AND DEPLOY”; part of the Halcyon Series™ Delivery Modal. Customers can

thereafter integrate Halcyon ONE™ in a controlled fashion and gain a compliance insight over systems on a case by case basis. It could be line of business applications are addressed first...or development to ensure consistency with live service builds. Halcyon will continue to engage with the customer under Stage 4# “CUSTOMISATION” and where requested to build intelligible and appropriate compliance policies, and direct them to target systems within their IT estate.

3.3 Component High Availability

As shown in Figure 3, high availability is built into all applicable components and again, Halcyon ONE™ achieves this within its construct...no complex integration at the virtual or physical storage level is needed. Table 4 below outlines the high availability technology used and where it is applicable.

High Availability Technology	Primary	Secondary
Multi-master replication	Domain Controller (Node 1)	Domain Controller (Node 2)
SQL Server Failover Clustering	SQL Server 2012 R2 (Node 1)	SQL Server 2012 R2 (Node 2)
StarWind Storage Replication	StarWind iSCSI Target Server (Node 1)	StarWind iSCSI Target Server (Node 2)

Table 4: Component High Availability

To expand on Table 4, the Domain Controllers use the built-in Windows Server 2012 Active Directory Directory Services multi-master replication topology to ensure the delegated authority model is always available active/active. The topology is maintained by ADDS and configured automatically during build.

SQL Server Failover Clustering maintains an active/passive dual-node approach by ensuring all transactions are written through a primary node, and should that node fail, the secondary is activated automatically and takes over the data processing. SQL Server Failover Clustering typically requires shared infrastructure; where both nodes maintain an active path to the data set in order to perform a seamless transfer in failover conditions. Halcyon ONE™ maintains this functionally by using a pair of virtual machines running StarWind Virtual SAN v8 that present a replicated iSCSI-targetable volume set.

StarWind Virtual SAN v8 uses local virtual hard disks and a synchronous replication topology (between two nodes) to ensure data written to the primary node is instantly written to the second. Fail at node level simply means data processing is transferred to the second node seamlessly, and transparent to the accessing SQL Server cluster.

The HA constructs provided through the virtual SAN, SQL Server Cluster and Domain Controllers ensures that single nodes can be patched, updated and upgraded without affecting the availability of the system.

The native availability target achieved by a vanilla deployment is 99.5; consistent with the design constructs outlined above.

Key Technical Design Decision 2#

At the time of writing, the Halcyon ONE™ baseline product only includes a single instance of SCCM. This is contra to other areas of the product that work to achieve high availability through differing technologies as part of the base build.

- * During product development, it was highlighted that a number of key features running on the SCCM node *can* operate in a high availability but require extensive setup in order to achieve them in automation. During Stage 1# "PRE-SALES", an target availability for the Halcyon ONE™ is identified with the customer. If that target exceeds the native 99.5 baseline provided by the solution, Halcyon will build-in additional high availability functionality as part of a post deployment task; but only if specifically requested to by the customer and would be delivered under 'Optional Services'.

4 Non-Functional Design

Purpose: This chapter all non-functional elements of the Halcyon ONE™ product.

4.1 Backup and Disaster Recovery

As outlined in §3.3 Component High Availability, Halcyon ONE™ is designed to be resilient against key component failure. However, it is important to reiterate that as a set of virtual instances housed on the customers' existing virtual infrastructure (VI), the solution is entirely reliant on the existing VIs' backup and disaster recovery mechanisms to defend against data loss and data corruption.

During Stage 1# "PRE-SALES", Halcyon Sales representatives will assess the capabilities of the existing virtual infrastructure. If it is found to be lacking in backup/DR provisioning, the baseline Halcyon ONE™ product may be bolstered with additional technology...but this is not part of the standard build and would be delivered under 'Optional Services'.

4.2 Sizing and Configuration Maximums/Minimums

Halcyon ONE™ has a baseline (**minimum**) build size (as outlined in Table 5 below) allows it to maintain compliance coverage of 1000 client agents (physical or virtual instances) and 500 network devices. Table 5 and its values maintain consistency with Microsoft Best Practices for sizing System Center Configuration Manager 2012 R2 and adjuncts accordingly.

Component Title	vCPUs	vRAM	vStorage	vNetwork
Domain Controller (Node 1)	2x (2.1 GHz)	4 GB	60 GB	1 GB
Domain Controller (Node 2)	2x (2.1 GHz)	4 GB	60 GB	1 GB
Certificate Services Server	2x (2.1 GHz)	4 GB	60 GB	1 GB
StarWind iSCSI Target Server (Node 1)	2x (2.1 GHz)	8 GB	180 GB	1 GB
StarWind iSCSI Target Server (Node 2)	2x (2.1 GHz)	8 GB	180 GB	1 GB
SQL Server 2012 R2 (Node 1)	2x (2.1 GHz)	8 GB	110 GB	1 GB
SQL Server 2012 R2 (Node 2)	2x (2.1 GHz)	8 GB	110 GB	1 GB
System Center Configuration Manager 2012 R2 Server	4x (2.1 GHz)	16 GB	110 GB	1 GB
TOTALS	18x (2.1 GHz)	60 GB	870 GB	N/A

Table 5: Sizing and Configuration Maximums/Minimums

4.3 Management / Support Interoperability

Halcyon ONE™ provides remote desktop access via the RDP protocol to all virtual server instances by default. Access is provided to all existing customer Privilege User (PU) administrators proxy of surfacing the global administrator account credentials for the Halcyon ONE™ domain. The customer is advised in Stage 1# "PRE-SALES" that a delegated authority model underpins the Halcyon ONE™ domain...but population of this with external administrator accounts is not part of the core build. The creation of additional administrator accounts is part of undertaken as part of the optional Stage 4# "CUSTOMISATION" (if required).

Presentation of remote access is entirely dependent of the design of customer virtual infrastructure. By default, a single management IP address on the Halcyon Core Network is identified during Stage 2# "CAPTURE" and the Halcyon ONE™ automated build locks down the virtual instances' local firewall to restrict RDP access to the defined address. This is controlled through group policy and applies to all Halcyon ONE™ instances.

4.4 Patching and Updates

Halcyon ONE™ maintains a perpetual patching and update cycle; proxy of the System Center Configuration Manager servers' Windows Software Update Services (WSUS) implementation and access to the Internet for Microsoft Updates. During automated build, the SCCM server is configured to grab all product-applicable updates from the Microsoft Update site which are downloaded to its local update repository. Update grab is perpetuated on a daily schedule. A second daily schedule is used to assess downloaded updates against those installed on the Halcyon ONE™ virtual instances. Required updates are automatically marked and transferred to the intended servers automatically. A final schedule (and staging order) is pre-defined that allows the virtual instances to install class/type-specific updates and patches in a fashion that causes limited impact to availability of Halcyon ONE™ services. To this end, instances that achieve high availability through partnerships look to have updates deployed in a controlled fashion to avoid both instances becoming unavailable at the same time. Single instance components undertaking updates that require a reboot will affect service availability. As per "Key Technical Design Decision 2#", availability expectations are captured during Stage 1# "PRE-SALES" and if the resulting service outage is in contrast to the desired availability target, Halcyon will work with the customer to build in any additional resiliency where required.

NOTE: Additional provisions in the area of availability bolstering will not exceed the capabilities of the Halcyon ONE™ product or its sub-products. Where a delta is identified, the customer will be advised and if Halcyon development time is required, this will fall as part of Stage 4# "CUSTOMISATION" and be chargeable.

5 Assumptions, Dependencies and Constraints

5.1 Assumptions

N/A

5.2 Dependencies

As listed in §4.1 Backup and Disaster Recovery, the Halcyon ONE™ product is highly dependent on existing backup and DR technologies and processes to defend against data loss and data corruption.

As listed in §4.4 Patching and Updates, the Halcyon ONE™ product is highly dependent on a connection to the Internet to draw down Microsoft Update; subject only to Microsoft Updates being provided locally by a valid update repository mirroring the Microsoft source.

5.3 Constraints

The Halcyon ONE™ product includes (subject to licensing) an extensive functionality portfolio beyond the scope of this document and linked to the wider capabilities of the Microsoft System Center suite. These include the elements listed below (non-exhaustive) and can be used to extend functionality into the IT estate:

- Configuration management
- Environment patching
- Environment anti-virus
- Software deployment.

The Halcyon ONE™ product is in no way constrained in used these additional functionalities and the customer is completely free to take advantage of them where applicable. Halcyon offers additional resources to work with the customer to develop and extend these features into the data centre as part of Stage 4# "CUSTOMISATION" where all work is chargeable.....but if the customer wants to take this on themselves, they are completely free to do so without reservation from Halcyon.

6 Appendix A – Compatibility Matrixes

Purpose: This chapter is used to outline compatibility information pertinent to the version of Halcyon ONE™ product.

6.1 Client Hardware Requirements

Requirement	Details
Processor and Memory	Refer to the processor and RAM requirements for the computers operating system.
Disk Space	<p>Windows XP and Windows 2003 both require a minimum of 256MB RAM 500MB available disk space, with 5GB recommended for the Configuration Manager client cache.</p> <p>Less disk space is required if you use customized settings to install the Configuration Manager client:</p> <ul style="list-style-type: none"> • Use the CCMSetup command-line property /skipprereq to avoid installing files that the client does not require. For example, CCMSetup.exe /skipprereq:silverlight.exe if the client will not use the Application Catalog. • Use the Client.msi property SMSCACHESIZE to set a cache file that is smaller than the default of 5120 MB. The minimum size is 1 MB. For example, CCMSetup.exe SMSCachesize=2 creates a cache that is 2 MB in size.

Table 6: Client Hardware Requirements

The following are additional hardware requirements for optional functionality in Configuration Manager.

Function	Minimum Hardware requirements
Operating system deployment	384MB of RAM
Software Center	500MHz processor
Remote Control	Pentium 4 Hyper-Threaded 3GHz (single core) or comparable CPU, with at least a 1GB RAM for optimal experience.
Out of Band Management	Desktop or portable computers must have the Intel vPro Technology or Intel Centrino Pro and a supported version of Intel AMT.

Table 7: Client Hardware Requirements for optional Configuration Manager functionality

6.2 Operating System Requirement for Configuration Manager Client Installation

Operating System	System Architecture
Windows XP Professional (SP3)	x86
Windows XP Professional for 64-bit Systems (SP2)	x64
Windows XP Tablet PC (SP3)	x86
Windows Vista <ul style="list-style-type: none"> Business Edition (SP2) Enterprise Edition (SP2) Ultimate Edition (SP2) 	x86, x64
Windows 7 <ul style="list-style-type: none"> Professional (with no service pack, or with SP1) Enterprise Editions (with no service pack, or with SP1) Ultimate Editions (with no service pack, or with SP1) 	x86, x64
Windows 8 <ul style="list-style-type: none"> Pro Enterprise 	x86, x64
Windows 8.1 <ul style="list-style-type: none"> Pro Enterprise 	x86, x64
WindowsServer 2003 Web Edition (SP2)	x86
WindowsServer 2003 <ul style="list-style-type: none"> Standard Edition (SP2) Enterprise Edition (SP2) Datacenter Edition1 (SP2) 	x86, x64
WindowsServer 2003 R2 SP2 <ul style="list-style-type: none"> Standard Edition Enterprise Edition Datacenter Edition1 	x86, x64
WindowsStorage Server 2003 R2 SP2	x86, x64
WindowsServer 2008 <ul style="list-style-type: none"> Standard Edition (SP2) Enterprise Edition (SP2) Datacenter Edition (SP2) 	x86, x64

The Server Core installation of Windows Server 2008 (SP2)	x86, x64
Windows Storage Server 2008 R2 <ul style="list-style-type: none"> • Workgroup • Standard • Enterprise 	x64
WindowsServer 2008 R2 <ul style="list-style-type: none"> • Standard Edition (with no service pack, or with SP1) • Enterprise Edition (with no service pack, or with SP1) • Datacenter Edition (with no service pack, or with SP1) 	x64
The Server Core installation of WindowsServer 2008 R2 (with no service pack, or with SP1)	x64
Windows Server 2012 <ul style="list-style-type: none"> • Standard • Datacenter 	x64
The Server Core installation of Windows Server 2012	x64
Windows Server 2012 R2 <ul style="list-style-type: none"> • Standard • Datacenter 	x64
Windows Storage Server 2012 R2	x64
The Server Core installation of Windows Server 2012 R2	x64

Table 8: Operating System Requirements for Configuration Manager Client Installation

6.3 Client Requirement for Mac Computers

Operating System	Additional Details
Mac OS X 10.6 (Snow Leopard)	Not applicable
Mac OS X 10.7 (Lion)	Not applicable
Mac OS X 10.8 (Mountain Lion)	Not applicable
Mac OS X 10.9 (Mavericks)	To use Mac OS X 10.9 with Configuration Manager you must use a Mac client for Configuration Manager with the following minimum versions: For System Center 2012 Configuration Manager SP1: Minimum client version 7804.1303 For System Center 2012 R2 Configuration Manager: Minimum client version 7958.1101 Additionally, for Configuration Manager SP1 with cumulative update 4, you can

	<p>install an optional update to add Mac OS X 10.9 to the supported platforms list. This update is not required for System Center 2012 R2 Configuration Manager with cumulative update 1.</p>
<p>Mac OS X 10.10 (Yosemite)</p>	<p>To use Mac OS X 10.10 with Configuration Manager you must use a Mac client for Configuration Manager with the following minimum versions: For System Center 2012 Configuration Manager SP1: Minimum client version 7804.1304 For System Center 2012 R2 Configuration Manager: Minimum client version 7958.1102 Additionally, you can install an optional update to add Mac OS X 10.10 to the supported platforms list.</p>

Table 9: Client Requirement for Mac Computers

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