Opal Market Requirements Document

MRD

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Author: John Hickey
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This document details the high-level product requirements for Opal – which provides a way to share Virtual Machines between many Emerald Receivers as well as RemoteApp.

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Master Document Revision History

Date	Version	Description	Author / Editor
Jul 29th, 2011	0.1	Initial Draft of product requirements	John Hickey

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1 Table of Contents

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2 Introduction

This high-level detailed product requirements (MRD) describes the complete set of requirements for the Opal unit as it evolves from inception through various product model and feature developments. The Opal unit will need to be compliant to Emerald system requirements of typical Transmitters in terms of APIs, stats logging and Boxilla management.

The intended audience includes project managers, developers, marketing staff, testers, and documentation writers.

2.1 Scope

The scope of the MRD is to define the functional and non-functional requirements of the *Opal* units and its operation within an Emerald system. Functional requirements specify actions that a system must be able to perform, without taking physical constraints into consideration. Functional requirements thus specify the input and output behaviour of a system, independent of implementation design. Functional requirements can also be used to specify what the system must NOT be able to perform.

The planned phases for the overall programme are:

Release 1.0 -*Opal Unit* – allow up to 8 users to share a Virtual machine on each of 16 virtual-machines accessed using RDP, RemoteFX, PCOIP and ultraPCOIP

In this document, where Emerald Receiver is used, it assume that this includes RemoteApp unless otherwise specified.

2.2 Overview of MRD Organization

Because of the distributed and diverse set of features supported by the *Emerald* system, the MRD has been generated as a set of distinct and independent chapters. These chapters may be part of this document or as the requirements size and complexity grows, they may be separated into separate documents for ease of maintainability.

Each requirement had two fields marked. The field headed *R/O* defines the feature as 'Required' (R) or 'Objective' (O). The *Release* field lists the release where the feature was added or the target future release (if known, otherwise 'F' or 'Future'.)

Definitions, Acronyms and Abbreviations

Term	Description
3DES	Triple DES (Data Encryption Standard)
AC	Alternating Current
AES	Advanced Encryption Standard
AGC	Automatic Gain Control
ASIC	Application Specific Integrated Circuit
BIS	Bureau of Indian Standards
BIST	BIST In Self-Test
CAP	CloudAccel Protocol (Same as Optimized Video Format)
CB	Certification Body
CD	Compact Disk

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Term	Description
CE	Conformité Européenne
CMN	Certification Model Number
CMU	Central Management Unit
CPU	Central Processing Unit
CTS	Clear to Send
HDCP	High-bandwidth Digital Content Protection
DC	Direct Current
DES	Data Encryption Standard
DHCP	Dynamic Host Configuration Protocol
DNS	Domain Name System
DPS	Detailed Product Specifications
DRAM	Dynamic Random Access Memory
DSP	Digital Signal Processing
DVI	Digital Video Interface
EDID	Extended Display Identification Data
ELMD	Entry Level Management Device
ESD	ElectroStatic Discharge
EuP	Energy using Products
FCC	Federal Communications Commission
FPGA	Field Programmable Gate Array
FQDN	Fully Qualified Domain Name
GUI	Graphical User Interface
HDCP	High-bandwidth Digital Content Protection
HID	Human Interface Devices
HTTP	Hypertext Transfer Protocol
IC	Integrated Circuit
IEC	International Electrotechnical Commission
IGMP	Internet Group Management Protocol
IP	Internet Protocol
ISTA	International Safe Transit Authority
JSON	JavaScript Object Notation
KVM	Keyboard, Video, Mouse
LACP	Link Aggregation Control Protocol
LAN	Local Area Network

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Term	Description
LED	Light Emitting Diode
MAC	Media Access Control
MPS	Multipoint Server
MRD	Marketing Requirements Document
MST	Multi-Stream Transport
NLA	Network Level Authentication
NOC	Network Operating Centre
OEM	Original Equipment Manufacturer
OS	Operating System
OSD	On Screen Display
PC	Personal Computer
PCI	Peripheral Component Interconnect
PCB	Printed Circuit Board
PID	Peripheral ID
PSU	Power Supply Unit
QIG	Quick Install Guide
QSG	Quick Start Guide
RDP	Remote Desktop Protocol
RDSH	Remote Desktop Session Host (formally Terminal Services)
REST	REpresentational State Transfer
ROHS	Restriction Of Hazardous Substances
RF	Radio Frequency
SDI	Serial Data Interface
SFP	Small Form factor Pluggable
SSH	Secure SHell
SST	Single Stream Transport
TCP	Transmission Control Protocol
UDP	User Datagram Protocol
UI	User Interface
UL	Underwriters Laboratories
URL	Uniform Resource Locator
USB	Universal Serial Bus
VDI	Virtual Desktop Infrastructure
VESA	Video Electronics Standards Association

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Term	Description
VGA	Video Graphics Adaptor
VID	Vendor ID
VM	Virtual Machine
VNC	Virtual Network Computing
WAN	Wide Area Network
WEEE	Waste Electrical and Electronic Equipment
XML	eXensible Markup Language

2.3 References

Ref 1. *Microsoft RDP Base Standard: MS_RDPBCGR*
Ref 2. *DVI 1.0 Standard*
Ref 3. *VESA*
Ref 4. *PC99 http://www.microsoft.com/whdc/archive/pcguides.mspx*
Ref 5. *RemoteFX RDP Specification*
Ref 6. *USB Redirection Specification*
Ref 7. *Domain Names - Implementation and Specification https://tools.ietf.org/html/rfc1035*
Ref 8. *Emerald DPS – ENG-000-001*
Ref 9. *Boxilla DPS – ENG-0007-030*
Ref 10. *RemoteApp DPS – ENG-0009-001*

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3 Overall Description

Opal is an x86 based platform using Ubuntu 20.04 (LTS) ***[TBC]*** of Linux that allows Emerald Receivers and RemoteApp to share a virtual machines. The system works by the Receivers connecting to the Opal unit. The protocol between the Receiver and Opal unit contains information that enables the Opal unit to know which Virtual Machine the Receiver wants to connect to. Up to 8 devices can connect to the same virtual machine.

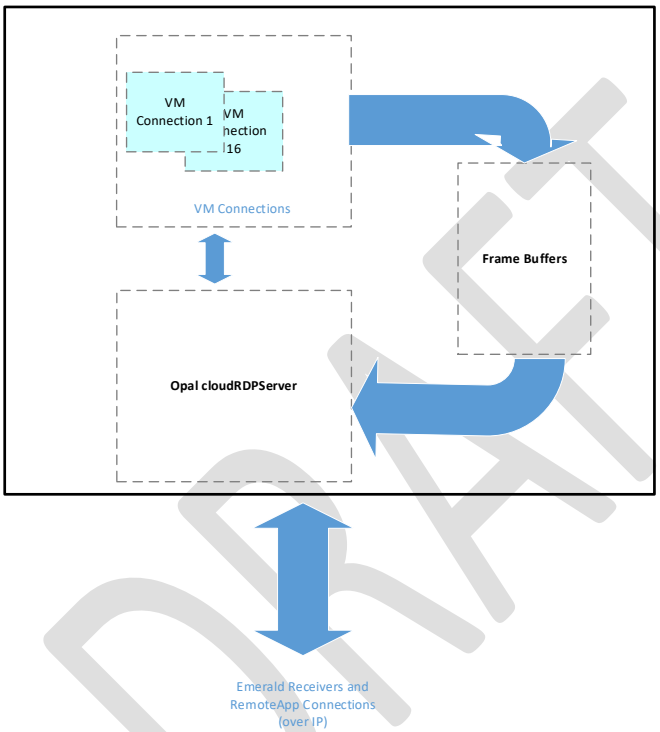

Figure 1 - Opal High-Level Block Diagram

Figure 1 shows a high level block diagram of the Opal system. Opal will launch a connection to a Virtual Machine using the defined protocol and parameters received from the connection request from the Receiver to the defined target virtual machine. cloudRDPServer takes the information from the connection request from a Receiver (protocol to use, parameters, etc.) and initiates a launch a virtual machine in VMConnections using these parameters. The VM Connection has the received video (or other information such as audio and USB) stored in the Frame Buffer. cloudRDPServer uses the video, audio and USB frames stored in the FrameBuffer to provide a stream of video and audio and keyboard/mouse back to the Receiver. If more than one Receiver has requested a connection to the same VM (with compatible properties) – cloudRDPServer shares the streams with this receiver as well (no VMConnection is attempted for another connection to VM with same protocol, etc..). This is how Opal enables VM sharing within an Emerald system.

Commented [JO1]: Will the cloudRDPServer run as a service? I assume we want it be compatible with standard Linux services?

Commented [JO2]: No sure what you are trying to say here

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4 System Requirements

4.1 System Components

Req. No.	Req. Source	Requirement Description	R/O	Release
SC0001		The *Opal* product family shall consist of a x86 hardware components platform running XXX of Linux. [Add a bit more on h/w definition here – i7, memory, etc.]	R	1.0
SC0002		The Opal product shall support being managed by Boxilla for system configuration and management. [Note: V1.0 release will not be managed by Boxilla for time-to-market reasons i.e. not to have to have a Boxilla release tied to Opal release.] Note – question – how to get Opal into domain so it can connection VMs or is this needed ? I think not – BBOX question.		F
SC0002a		All Emerald Receivers – EMD-SE, EMD-PE and EMD-4k as well as RemoteApp will be able to connect to Opal to initiate a VM connection that can be shared.	R	1.0
SC0002b		Opal will be rack-mountable in a standard 19inch rack.	R	1.0
SC0003		Opal will have a local serial port to allow for basic configuration of unit which will support at least: 1. Display IP address and allow it to be set 2. Reset unit to factory defaults 3. Set and Support Serial Password	R	1.0
SC0003a		How much configuration will we allow for "unmanaged" Opal – i.e. how to access tables, etc. ?		
SC0005		The system shall support the extension of Video, Audio and USB peripherals (only keyboard/Mice) from a remote Virtual Machine over an IP network using (a) RDP (b) RemoteFX (c) PCOIP and (d) PCOIPultra.	R	1.0
SC0005d		*Blast* extensions, VNC and H.264 Encoders to be supported.	R	F

4.2

4.3 Configuration Management

Req. No.	Req. Source	Requirement Description	R/O	Release
CM0001		Opal can be configured by an admin via either: 1. Serial port, or 2. Web browser	R	1.0

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Req. No.	Req. Source	Requirement Description	R/O	Release
		Engineering to decide which of the two methods to be used		
CM0002		The admin must login to change to configuring (using which ever method selected in CM0001 – this is not a linux level login).	R	1.0
CM0003		The admin must be able to change serial port / configuration login method username and password.	R	1.0
CM0004		Admin can set the (a) min. of characters to be from 4 to 10 in a password (b) define at least one of number, letter or special character to be required as part of password.	R	1.0
CM0005		Password can be a maximum of 32 characters following standard Microsoft win10 rules of what can be including in a password – password can be "blank" if allowed by admin (CM0004 setting).	R	1.0
CM0006		Username can be a maximum of 32 characters following standard Microsoft win10 rules of what can be including in a password.	R	1.0
CM0007		Factory default username and password to be same as standard Emerald devices – username = "admin" and password-"admin".	R	1.0
CM0008		Admin can configure the "mapping" of port numbers to VM Connections – up to 1000 mappings will be supported.	R	1.0
CM0009		VM Connection will be definition of (a) IP or Host of target VM, (b) Protocol to use (RDP/RFX, PCOIP/PCOIPultra) (c) whether audio is enabled or not (d) time-out parameter – whether uses system default or has unique one (e) Username & Password to be used for VM connection (if any – can be blank). Note: USBr is not supported in 1.0 release – but to be added to in future.	R	1.0
CM0010		Connection table and VM properties can be imported from a thumb-drive.	R	1.0
CM0011		Connection time-out is the period of time after when no Rx is connected to this VM , the VM connection is logged-out/terminated – hence free up a "slot" for another VM if needed.	R	1.0
CM0011a		The Opal unit will have a system default for VM Connection Time-out – which the admin can change. The default will be 10 seconds and can be configured from 0 secs (i.e. terminate immediately when no Rx connected) to 10 mins or "never". The reason for VM Connection is to remove the need to "login" to a VM connection repeatly – as in some systems this may take 20-30 seconds.	R	1.0

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Commented [JO3]: Will it be managed by Boxilla
Commented [JO4]: Do we need a restore to factory defaults.
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4.4 Scalability Requirements

Req. No.	Req. Source	Requirement Description	R/O	Release
SR0001		Opal will support 8 Receivers sharing a VM connection at the same time and up to 16 VM connections at the same time (i.e. up to 8x16 receivers can be connected to Opal simultaneously).	R	1.0
SR0002		Each Rx should be able to get a minimum of 15 fps of a 60fps HD movie running on VM (assuming VM is not bottleneck). [Need to review this in light of RFX scaling numbers]	R	1.0
SR0002		Network bandwidth is 1Gbps maximum (note: need to review with SR0002 as municast probably will take ~10Mbps per stream which can conflict with numbers @15fps).	R	1.0
SR0071		The *Receiver* shall connect to a RDP 8.1 enabled server running VDI and support the RemoteFX video enhancements for *Windows Server 2016* when hosting virtualised *Windows 7* machines or *Windows 10* machines.	R	5.2 1.0 (4K)

Commented [JO5]: Does this mean we can have 128 simultaneous connections.

Commented [JO6]: Does this means the system must be capable of processing by 60X15X8=7680fps throughput?

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4.5 Device System Compatibility

4.6 Connection Types

Req. No.	Req. Source	Requirement Description	R/O	Release
DC001		All existing *Connection* types between Emerald *Receivers* shall continue to be supported as follows: - Private - Shared (Multi-Unicast) - View-only	R	1.0
DC0024		All Receivers in a shared connection should see the mouse move around simulateous (as per Rx connection to a Tx)	R	1.0
DC0024		"HID" channel control is arbitrated based on a timer (user defined 0 to 10 seconds) – default 1 second – first person gets HID when they are first to move mouse and retain it (KM from others ignored) until they have not moved mouse/keyboard for time-out period.	R	1.0
DC0025		Opal should sent back approiate error message to an Rx if cannot connect to VM, too many people already sharing VM, all VM "slots" busy.	R	1.0

Commented [JO7]: This will require additional error processing in the RXs because these messages and exit codes may be unique to this setup.

4.6.1.1 Performance

Req. No.	Req. Source	Requirement Description	R/O	Release
Per001		Opal should not add more than 8ms to audio or video latency or mouse latency – over and above connection for Rx direct to a VM.	R	1.0
Per002		Audio/Video lip-sync should be maintain – Opal should not add more than +/-8ms jitter (i.e. half a frame time).	R	1.0
Per003				

Commented [JO8]: Does this apply to a fully loaded system. 8 X 16 connections?

Commented [JO9]: Does this apply to a fully loaded system. 8 X 16 connections?

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4.6.2 VM Compatibility

Req. No.	Req. Source	Requirement Description	R/O	Rls
SV0001		The *Receivers* shall be able to connect to a Windows OS version 7 and 10 using the RDP protocol when hosted on a VMWare ESXi server, Windows Server 2016 or direct to Win10 PC	R	1.0
SV0002b		The *Emerald Receivers* shall be able to connect to a Windows OS version 7 and 10 using the PCoIP protocol when hosted on a VMWare ESXi server running version 6 or earlier and provided the appropriate licencing is applied.	R	1.0
SV0003		The *Receivers* shall be able to connect to a Teradici cloudAccess using PCOIP/PCOIPUltra.	R	1.0
SV0004		In future support for Blast and VNC and H.264/H.265	R	F
SR0080		Appropriate user messaging shall be displayed during persistence retries showing *Connection* attempts.	R	F

Commented [JO10]: How do we configure these connections. Is this to be done through the serial interface?

4.6.3 Fast Switching and Disconnection

Req. No.	Req. Source	Requirement Description	R/O	Release
SR0035		A connection should be made from an Rx < 1 sec if VM Connection already established.	R	1.0
SR0035a		A connection should be made from an Rx < 3 sec if VM Connection not already established for "lab" based VM Server where loggin is <2 from a Win10 PC to connect to that VM. i.e. Opal should add no more than 1 second to connection establishment to an Rx over time taken from a Win10 PC to connect to that VM.	R	1.0
SR0035b		Discconntion of Rx should be < 0.5 second.	R	1.0

4.6.4 Session Security

Req. No.	Req. Source	Requirement Description	R/O	Release
SR0055		The *Receiver* shall negotiate TLS (1.2 only – 1.0 and 1.1 viewed as weak) security levels using the RC4, DES, 3DES and AES algorithms with Virtual Machines.	R	1.0
SR0056		The *Receiver* shall support Network Level Authentication (NLA) for connection with Virtual Machines. (Not default)	R	1.0
SR0040		All communication security shall use 128bit security keys.	R	1.0

Commented [JO11]: I assume this is the connection between the receiver and the cloudrdp server. If so, this requires receiver changes, we do not currently support TLS.

Commented [JO12]: See above

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4.6.5 DNS

Req. No.	Req. Source	Requirement Description	R/O	Release
SR0045		It shall be possible to connect to a target VM or *Transmitter* by resolving a target name using DNS rather than defining an IP address in the connection table of Opal.	R	1.0
SR0045a		It shall be possible for Rx to connect to Opal by resolving a target name using DNS rather than defining an IP address for Opal unit.	R	1.0
SR0045b		The connection information should be removed from the cache, 30 minutes after the last successful "resolution" with DNS server for that name.	R	1.0
SR0045c		Should a connection attempt using cached information fail, then the DNS server should be polled for the correct information and updated if different.	R	1.0

4.6.6 Connection Broker

Req. No.	Req. Source	Requirement Description	R/O	Release
SR0046		The *Opal* shall allow redirection by a *Microsoft* connection broker or Teradici Connection Broker to facilitate load balancing or server farm configurations.	R	1.0 ??

4.6.7

4.7 Active Directory Authentication

Req. No.	Req. Source	Requirement Description	R/O	Release
SR0050		?????		F

4.8 Feature Licencing

Req. No.	Req. Source	Requirement Description	R/O	Release
FL0001		??? We may need to add Teradici licensing mechanism.	R	1.0

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5 User Interface Requirements

The following section gives general outline of the Admin Configuration requirements and general user interaction. It is not intended to be a style guide or a detailed flow chart operation. In practice, the detail styling and behaviour of the user interface will be tuned and tweaked between the Engineers and Marketing people.

5.1 User Interface System

Req. No.	Req. Source	Requirement Description	R/O	Release
UI0001		?? – to be updated once decide on Web page vs Serial questions	R	1.0

Commented [JO13]: I asuume we want to have SSH open for maintenance and support.

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6 Physical requirements

6.1.1.1 Network

Req. No.	Req. Source	Requirement Description	R/O	Release
TX0060		???		1.0

6.1.1.2 Audio

The *EmeraldSE* single-head *Transmitter* has an audio option.

Req. No.	Req. Source	Requirement Description	R/O	Release
TX0061		???? Should we have local "audio" to allow connection without Rx (ie. Local user on box) ???	R	F

6.1.1.3 Serial

The *EmeraldSE* single-head *Transmitter* has a serial option.

Req. No.	Req. Source	Requirement Description	R/O	Release
TX0065		The *EmeraldSE* single-head *Transmitter* connector shall be a RJ45 connection with the following pins: - TXD - RXD - DCD - DSR - DTR - CTS - RTS	R	4.4
TX0066		The serial port shall be configured as a DCE (Data Circuit-terminating Equipment) device.	R	4.4
TX0067		The serial port shall support baud rates up to 115.2kb.	R	4.4

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6.2 Regulatory Requirements

The products shall be designed to meet the following regulatory standards.

Req. No.	Req. Source	Requirement Description	R/O	Release
HW0001 a		Emissions ▪ Emissions to EN55032:2015 Class A ▪ Emissions to FCC Class A Immunity to EN55024: 2010 ▪ Immunity tests comprised of: ▪ ESD (EN61000-4-2:2009) ▪ Radiated RF immunity (EN61000-4-3: 2006 +A1:2007 + A2:2010) ▪ Fast Transients (EN61000-4-4: 2004 + A1:2010) ▪ Surges (EN61000-4-5: 2006) ▪ Conducted RF Immunity (EN61000-4-6: 2009) ▪ Magnetic Field Immunity (EN61000-4-8: 2010) ▪ Voltage Dips & Interruptions (EN61000-4-11: 2004) [Update will latest spec]	R	1.0
		▪		
		▪		
		▪		
		▪		
		▪		
		▪		

6.3 Environmental Requirements

Req. No.	Req. Source	Requirement Description	R/O	Release
HW0012		The units shall be designed and tested to the following operating conditions: Ambient Temperature Range: (local to appliance) 0 to 40° C Operating Humidity Range: 10 to 90% (Non-condensing)	R	1.0

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Req. No.	Req. Source	Requirement Description	R/O	Release
HW0016		The units shall be designed to meet the requirements of the ROHS2, REACH and WEEE directives.	R	1.0
HW0017		The units shall be compliant to the requirements of the EuP (Energy using Products) Directive	R	F

6.4 Logos and Labels

Req. No.	Req. Source	Requirement Description	R/O	Release
HW0008		Adhesive labels on the bottom of the unit shall list the following information: • Model Name and Number • Regulatory information • Hardware Serial Number • MAC address • Country of Manufacture • Compliance Model Number (if required) • WEEE • Manufacturing Date Code information (integrated in serial number) [Tom to define requirements here]	R	1.0

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7 Branding and Sales Requirements

7.1 Branding Requirements

7.1.1 Black Box Branding

7.1.1.1 Brand Names

Req. No.	Req. Source	Requirement Description	R/O	Release
BR0031		The model name for the Opal unit shall be EMDXXXX .	R	1.0
BR0067		The model name for the ???	R	1.0

7.1.1.2 Opal Unit Finish and Colours

Req. No.	Req. Source	Requirement Description	R/O	Release
BR0026		The units shall be painted black. ???	R	1.0
BR0029		The unit lids shall have the Black Box logo screened in white.	R	1.0
BR0030		The logo and markings on the unit shall be printed in Pantone process Blue U and white.	R	1.0

8 Approvals

This Market Requirements Document requires the approval of each of the individuals listed below. By signing below, each member (or their designee) acknowledges that they understand and agree with the requirements as described in this DPS.

Modification of this DPS requires a re-issue of this document that clearly identifies the changes and must also be signed by each of these individuals.

_____ Product Manager
Date Tom Fitzgerald

_____ Director of Engineering
Date Peter Shelley

_____ Validation Manager
Date John Hickey

_____ Software Architect
Date John O'Sullivan

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9 Appendix B: Valid DNS Names

Valid DNS names for the CloudLinc product are defined at http://support.microsoft.com/kb/909264.

DNS host names

Allowed characters

DNS names can contain only alphabetical characters (A-Z), numeric characters (0-9), the minus sign (-), and the period (.). Period characters are allowed only when they are used to delimit the components of domain style names.

In the Windows 2000 domain name system (DNS) and in the Microsoft Windows Server 2003 DNS, the use of Unicode characters is supported. Other implementations of DNS do not support Unicode characters. Avoid Unicode characters if queries will be passed to the servers that use non-Microsoft implementations of DNS.

For more information, visit the following non-Microsoft Web sites:

http://www.ietf.org/rfc/rfc952.txt

(http://www.ietf.org/rfc/rfc952.txt)

http://www.ietf.org/rfc/rfc1123.txt

(http://www.ietf.org/rfc/rfc1123.txt)

Disallowed characters

DNS host names cannot contain the following characters:

- comma (,)
- tilde (~)
- Colon (:)
- Exclamation point (!)
- at sign (@)
- number sign (#)
- dollar sign ($)
- Percent (%)
- caret (^)
- ampersand (&)
- apostrophe (')
- Period (.)
- parentheses (())
- braces ({})
- underscore (_)
- white space (blank)

The underscore has a special role, as it is permitted for the first character in SRV records by RFC definition, but newer DNS servers may also allow it anywhere in a name. For more details, see: http://technet.microsoft.com/en-us/library/cc959336.aspx

(http://technet.microsoft.com/en-us/library/cc959336.aspx)

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More rules are:

- All characters preserve their case formatting except for American Standard Code for Information Interchange (ASCII) characters.
- The first character must be alphabetical or numeric.
- The last character must not be a minus sign or a period.

In Windows 2000 and in later versions of Windows, computers that are members of an Active Directory

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domain cannot have names that are composed completely of numbers. This restriction is because of DNS restrictions.

Minimum name length

- 2 characters.

Maximum name length

- 63 characters.

The maximum length of the host name and of the fully qualified domain name (FQDN) is 63 bytes per label and 255 bytes per FQDN.

Note Windows does not permit computer names that exceed 15 characters, and you cannot specify a DNS host name that differs from the NETBIOS host name. You might however create host headers for a web site hosted on a computer and that is then subject to this recommendation.

In Windows 2000 and in Windows Server 2003, the maximum host name and the FQDN use the standard length limitations that are mentioned earlier, with the addition of UTF-8 (Unicode) support. Because some UTF-8 characters exceed one octet in length, you cannot determine the size by counting the characters.

Domain controllers must have an FQDN of less than 155 bytes.

Reserved names per RFC 952

- -GATEWAY
- -GW
- -TAC

(http://tools.ietf.org/html/rfc952)

Reserved names in Windows

See "Table of reserved words."

Best practices

When you create names for the DNS computers in a new Windows Server 2003 DNS infrastructure, use the following guidelines:

- Choose computer names that are easy for users to remember.
- Identify the owner of the computer in the computer name.
- Choose a name that describes the purpose of the computer.
- For ASCII characters do not use character case to indicate the owner or the purpose of a computer. For ASCII characters, DNS is not case-sensitive, and Windows and windows applications are not case-preserving in all places.
- Match the Active Directory domain name to the primary DNS suffix of the computer name. For more details, see the "disjoint domain names" section below.
- Use a unique name for every computer in your organization. Avoid the same computer name for computers in different DNS domains.
- Use ASCII characters. This guarantees interoperability with computers that are running versions of Windows that are earlier than Windows 2000.
- In DNS computer names, use only the characters that are listed in RFC 1123. These characters include A–Z, a–z, 0–9, and the hyphen (-). In Windows Server 2003, DNS allows most UTF-8 characters in names. However, do not use extended ASCII or UTF-8 characters unless all the DNS servers in your environment support them.

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