DESCARTES™

HOSTING RECOMMENDATIONS AND CONSIDERATIONS

Descartes® Route Planner™

May 2017

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Descartes® Route Planner™

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Introduction

1.1 Document Purpose

This document provides an overview of the recommended approach and strategies to hosting Descartes® Route Planner™. Descartes Route Planner is typically considered to be a mission critical application as it affects the day to day operations of the fleet.

1.2 Intended Audience

- Client IT team
- Client Network Team
- Client Infrastructure/Hosting Team
- Client Clustering Team
- Client Virtual Center Team
- Descartes Management Team
- Descartes Professional Services Team

2 Requirements

2.1 Server Software/Hardware

User Interface (UI), Integration (BE), Background Optimizer (BGO) Servers

- Intel® Xeon® Processor E3 or better
- Windows Server® 2008 R2 (64-bit) or Windows Server® 2012 R2 (Preferred)
- Disk Space 50gb for data & logs
- 1.5 - 2gb RAM per vCPU, minimum 4gb
  - ➲ **Note—** must be in the same domain as the Database servers.

Descartes AltaMap Map Server (ME, LPS, RMWS, Tiling)

- Intel® E5530 Xeon® CPU, or higher.
  - The key consideration is the CPU includes built-in memory controller and support three or more memory channels.
- Windows Server® 2008R2 (64-bit) or Windows Server® 2012 R2 (Preferred)
- Typically 16-64 GB Ram
- The requirements of the server will vary depending on which role the server is used for
  - ➲ **Note—** a single server can provide one or more of the following roles.

Tiling Only

- 4+ vCPU required
- 16+ GB of RAM
  - ➲ **Note—** Amount required depends on geography used and if a RAM disk is used
- SSD Disk preferred
  - ➲ **Note—** spinning disks will reduce performance noticeably when new tiles are required
- Cache All setting recommended (required if not using SSD)
- Virtual Machines supported

Map Editor (ME)

- 4+ vCPU required
- 16+ GB of RAM
  - ➲ **Note—** Amount required depends on geography used Virtual Machines supported

LNOS Pathing Service (LPS)

- 4+ vCPU required, 8 vCPU recommended
  - **Note—** This will depend on implementation requirements
- 32+ GB of RAM
  - **Note—** Amount required will depend on size of deployment and cache retention period
- Virtual Machines supported
- OS Power Options should be configured for High Performance

Route Matrix Web Service (RMWS)

- 4 **Physical** cores required (8 HyperThreaded), 2.8Ghz Minimum
  - **Note—** For larger implementations requiring more than 4 RMWS servers, it is recommended to move up to 16 Physical cores (8 per socket) and 48+gb of RAM with half the number of servers.
  - **Note—** 24 Physical cores (12 per socket) is **not** recommended as the clock speed drops significantly beyond 8 cores per socket (3.2ghz → 2.5ghz).
- 24+ GB of RAM (1.5gb per HT core)
  - **Note—** Amount required depends on geography used and if a RAM disk is used
- Virtual Machines **NOT** recommended. If virtualizing it may be necessary to allocate up to 30% more hardware.
- BIOS power saving should be configured in **Performance** mode, not Performance per Watt or any other profile.
  - **Note—** This can change performance by as much as 20-30%. See appendix 7.16 RMWS and Power Management for more details.
- OS Power Options should be configured for High Performance

The following provides a general estimate of the hardware required for the various roles depending on the size of implementation. When traffic is not used, the size is approximately half.

ME – Map Editor

LPS – LNOS Pathing Service

RMWS – Route Matrix

Deployment Size:	Server Roles	# Servers	# HT /vCPU	VM?	RAM	Disk
Small: < 50 trucks ~20 stops/rt 40% repeat	Tiling	2	4-8	Yes	24-48gb	20-40gb
	LPS					
	ME					
	RMWS					
Medium: < 400 trucks ~20 stops/rt 40% repeat	Tiling	2*	4	Yes	16-32gb	10-25gb
	LPS	1-2	4-8	Yes	24-48gb	10-20gb
	ME	2*	1	Yes	16-32gb	N/A
	RMWS	2-3	16	NO	16-32gb	10-25gb
Large: < 1000 trucks ~20 stops/rt 40% repeat	Tiling	2*	4	Yes	16-32gb	10-25gb
	LPS	2-3	8	Yes	48-96gb	20-40gb
	ME	2*	4	Yes	16-32gb	N/A
	RMWS	4-6	16	NO	16-32gb	10-25gb

- **Note—** These sizes are approximations; the LPS/RMWS can vary significantly depending on usage patterns.
- **Note—** * means it is usually "absorbed" by another server
- **Note—** Tiling requirements depend on geography; can co-exist with other servers, usually RMWS
- **Note—** LPS requirements depend on size of cache
- **Note—** ME can only have one active; can co-exist with other servers, usually LPS
- **Note—** RMWS requirements depend on size of problem and % new points

Database Server (Database, SQL)

- Intel® Xeon® Processor E5 or better
- 16 GB RAM (minimum)
- At least 30 GB of available disk space on system partition.
- Dedicated (separate) storage for Data, LOG and TempDB preferred.
- Size and IOPS requirements will vary per customer volume and throughput requirements.
- RAM requirements will also change, based on volumes, since SQL Server® operates better with more RAM.
- Windows® 2008 R2 or Higher
- SQL Server® 2008 R2 or Higher, either standard or enterprise edition
- SQL Server® 2012 (Descartes Route Planner 14.x or higher) standard or enterprise edition

  ➲ Note— Must be in the same domain or in a trusted domain as the user interface, integration, BGO or Map Editor servers as the application relies on SQL Integrated Authentication (SSPI). See the *SQL Server Security* section for details on required SQL permissions.

Tunnel Server

- Windows Server® 2003 (32-bit)
- Windows Server® 2008 (32/64-bit)
- Windows Server® 2012 (32/64-bit)
- Windows Server® 2012 R2

2.2 Client Hardware/Software

The current minimum requirements are as follows:

- Intel® Core™ i5-4440 Processor or similar
- Microsoft® Windows® 7 Professional (64-bit) or higher
- 4GB DDR3-1600 RAM
- Internet Explorer® 9.0 or later (10 Preferred)
- Silverlight® 2.0 or higher

➲ **Note—** Internet Explorer® 6 at this time does function however there are known memory leaks within Internet Explorer® that can cause significant performance degradation with Descartes Route Planner.

➲ **Note—** the Microsoft® EDGE browser is not currently supported. If using Windows® 10, Internet Explorer® 11 will need to be installed. It can be downloaded from: http://go.microsoft.com/fwlink/p/?linkid=290956

2.2.1 Browser Configuration

Descartes Route Planner requires a few browser configurations changes to work correctly. It is recommended that these configurations are distributed using group policy to avoid individual requirements for users. Descartes Route Planner will work without these changes but users may experience oddities or not be notified of certain errors.

The three major configuration changes are:

- Setup as a trusted site
- Setup site as compatibility mode
- Setup refresh on "Every visit to this webpage"

In addition, it is recommended that "Show Friendly HTTP Error Messages" is disabled so that more detailed messages are available to customer support.

For step-by-step instructions on how to configure these settings please see appendix *7.15 Configure Internet Explorer for use with Descartes Route Planner*.

2.3 Installation Requirements

2.3.1 Microsoft® components

Microsoft® URL Rewrite 2.0 is required for the new security features in versions 13.2.3 and higher. This component must be installed on Descartes Route Planner servers types (except SQL). This component can be downloaded from the following URL:

http://www.iis.net/downloads/microsoft/url-rewrite

2.3.2 Workgroup Requirements (no Domain):

If the Application Server and Database Server are in one workgroup, but not in one domain, then the SQL Server® should be running under the Administrator name (not under Local System Account). The Administrator name and password should be the same on both computers.

➲ **Note—** If SQL is on a different host (recommended), the SQL Server® service must be running under a domain account (otherwise the restore process as part of the install will fail).

To change the user name for the SQL Server®, go to Services and find MSSQL service. Right-click on MSSQL service and from the right-click menu, select: Properties. On the Log On page, select This Account and enter the Administrator user name and password. If the Application Server and Database Server are not in the same domain then refer to *Appendix D*.

2.3.3 Account Requirements

Descartes Route Planner requires a domain account which will be used for all running services and components. This account needs to be configured as a local administrator on each of the application servers.

This service domain account needs to be configured in SQL with SysAdmin privileges.

➲ **Note—** Sys-Admin privileges are only required during new installations and upgrades. These privileges are not required for normal application usage.

The SQL Server® must be running under a Windows® domain account because the installer requires the SQL to have network access to the installation machine in order to access certain files.

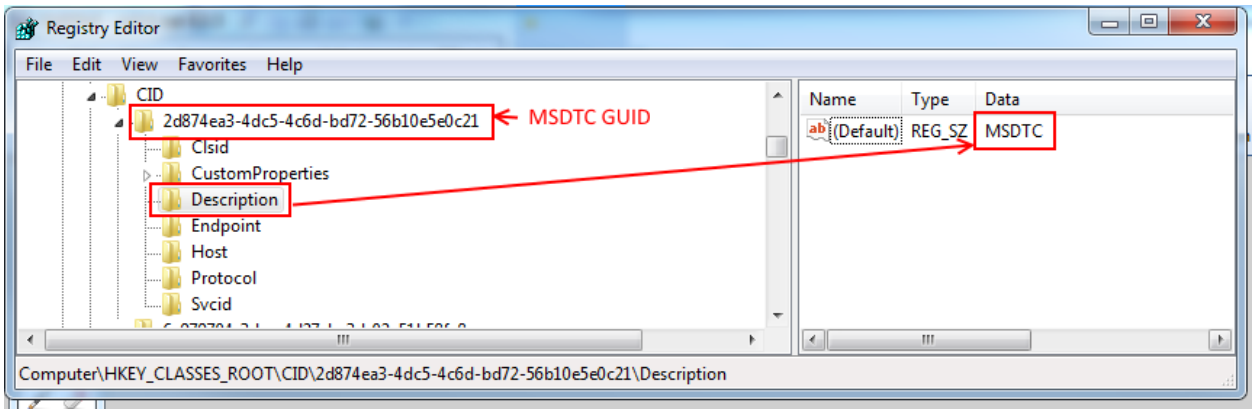
To change the user name for the SQL Server®, go to Services and find MSSQL service. Right-click on MSSQL service and from the right-click menu, select: Properties. On the Log On page, select This Account and enter the Administrator user name and password. If the Application Server and Database Server are not in the same domain then refer to *Appendix D*.

2.3.4 Microsoft® Distributed Transaction Coordinator (DTC)

Descartes Route Planner (and all other LNOS Products) relies on the Microsoft® Distributed Transaction Coordinator component (MSDTC). MSDTC must be enabled and has specific configuration requirements on both the application servers (UI, BIF, BGO) and SQL. See the Appendix for details on how this component should be configured. MSDTC uses a range of dynamic ports to facilitate communication. See the Firewall section below for more details on how pots should be configured.

MSDTC CID values must be unique across servers. If cloning servers, it is necessary to install MSDTC after the cloning process or you will need to uninstall MSDTC and reinstall (rebooting in between).

➲ **Note—** Installation can be verified by searching the HKCR\CID section of the registry for the key that has a description of MSDTC.



For more information about MSDTC please see this article.

2.3.5 Firewall

Descartes Systems Group recommends that a firewall is not placed between the various application components or between the application components and SQL

Server®. Introducing a firewall can increase latency and also provides the potential for misconfiguration, preventing the application from functioning.

If a hardware firewall is in place between application servers and the SQL Server®, it must be specially configured to support MSDTC by opening a range of ports for MSDTC to use. In addition, each server will need a registry update to restrict the range of ports MSDTC uses to match the firewall configuration. If this update is not done, some or all transactions could fail. MSDTC uses two-way communication, so the firewall must be configured to allow traffic in *both directions.*

See this link for more details.

It is recommended that Windows® firewall is disabled. If it is not, the Windows® firewall will need to be configured to allow MSDTC traffic on both the application servers and SQL Server®.

See this link for details on how to do this.

This article provides guidance on how to troubleshoot MSDTC firewall issues.

2.3.6 Windows® 2008/2012 Application Server component requirements

2.3.6.1 Descartes Route Planner (UI, Backend/Interface, BGO)

Roles

- IIS needs to be installed with the following components enabled:
  - HTTP Redirection
  - ASP.NET
  - ASP
  - Server Side Includes
  - Logging Tools
  - Tracing (see appendix for configuration details)
  - Basic and Windows® Authentication
  - Dynamic Content Compression
  - IIS Management Scripts and Tools
  - Management Service
  - IIS6 Management compatibility

Features

- Microsoft® Message Queuing (MSMQ)
  - Standard components should be enabled
  - Microsoft® Active Directory® Integration should be turned off

Other

- Domain account setup as local administrator to be used as a "service" account.
- Domain account setup with "Run as a Service" rights.
- Install Microsoft® Silverlight®

- Install Microsoft® .NET 2, 3 and 4.
  - Install after IIS to ensure it is correctly configured for IIS
  - If installed before you will need to run
    - c:\windows\microsoft.net\Framework
    - Change to the appropriate version
    - Run aspnet_regiis -i
    - Repeat for Framework 64 if using a 64-bit OS

Microsoft® Distributed Transaction Coordination (DTC)

- Enabled and Configured for No Authentication (see appendix for instructions)

Windows® Firewall Configuration

- Ensure exclusions for MSDTC

2.3.6.2 Descartes AltaMap (LPS, ME, RMWS, Tiling) Map Server

Roles

- IIS needs to be installed with the following components enabled:
  - ASP.NET
    - Server Side Includes
    - Logging Tools
    - Dynamic Content Compression
    - IIS Management Scripts and Tools
    - Management Service

Other:

- Install Microsoft® .NET 4.
  - Install *after* IIS to ensure it is correctly configured for IIS
  - Can be manually configured by running the following command from a console:
    - C:\Windows\Microsoft.NET\Framework64\v4.0.30319
    - aspnet_regiis.exe –i

➲ **Note—** The Framework folder will be just "Framework" for 32-bit versions. the v#### will vary depending on which version requires installation.

2.3.6.3 Microsoft® SQL Server®

SQL Server® 2005, 2016

- **Mixed Mode** installation is NOT required (Descartes Route Planner 16.03 and later). See SQL Server® Security section for details on required SQL permissions.
- **Max degree of parallelism** should be configured at 1-4 depending on the number of cores on the SQL Server® host as Descartes Route Planner is an OLTP type system.

- View current setting:

```
EXEC sp_configure 'show advanced options', 1

GO

RECONFIGURE

GO

EXEC sp_configure 'max degree of parallelism'
```

- Reconfigure (configure # below in the range 1-4):

```
EXEC sp_configure 'max degree of parallelism',#

GO

RECONFIGURE

GO
```

- **Parameterization should be enabled** for the FW and Sec databases. This setting must be enabled after the application is installed and configured.
  - Identify Databases:

```
use DCF

select h.ServerName, dh.domainname, h.DatabaseName

from DCFDomainHost dh

join DCFHost h on dh.HostID=h.HostID

join master..sysdatabases db on h.DatabaseName=db.name

where dh.ApplicationName in ('LNOSFW','SecAdmin')
```

  - Change setting:

```
alter database [DatabaseName] set parameterization FORCED
```

- Memory Configuration
  - SQL Server® Memory should be configured to use most of the memory available on the SQL Server®. There should, however, be a memory buffer to allow for normal day-to-day user/operating systems.
  - The following table provides general recommendations for memory usage on a x64 database server (assuming no other components are enabled):

Physical Server Memory	SQL MaxServerMemory
2GB	1500
4GB	3200
6GB	4800
8GB	6400

12GB	10000
16GB	13500
24GB	21500
32GB	29000
48GB	44000
64GB	60000
72GB	68000
96GB	92000
128GB	124000

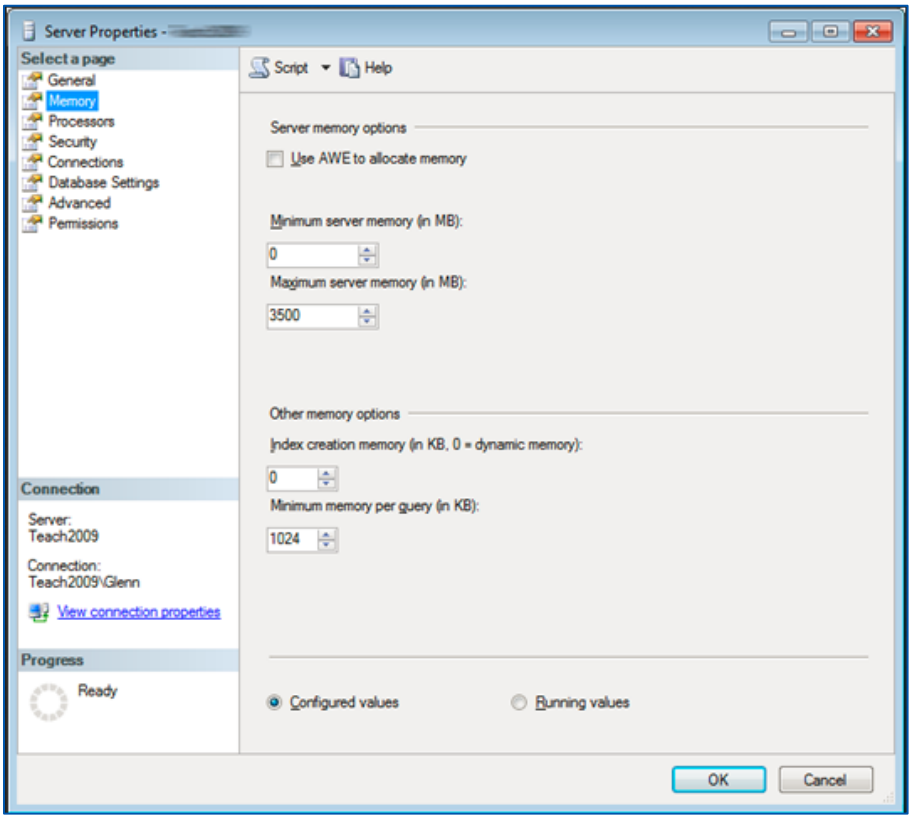
- If using other applications or SQL components additional buffer should be provided. The requirements will vary by environment. The following table provides an outline of target memory utilization (under load):

Physical Server Memory	Target Available Memory in Task Manager
< 4GB	512MB – 1GB
4GB – 32GB	1GB – 2GB
32GB – 128GB	2GB – 4GB
> 128GB	> 4gb

- You can use Microsoft® T-SQL to set your MaxServerMemory setting. The sample below sets it to 3500, which is the equivalent of 3.5 GB. This setting is dynamic in SQL Server® 2005/2008/2012, which means that you can change it and it goes into effect immediately, without restarting SQL Server®.

```
-- Turn on advanced options
EXEC  sp_configure'Show Advanced Options',1;
GO
RECONFIGURE;
GO

-- Set max server memory = 3500MB for the server
EXEC  sp_configure'max server memory (MB)',3500;
GO
RECONFIGURE;
GO
-- See what the current values are
EXEC sp_configure;
```

- You can also change this setting in the SSMS GUI, as shown below:



- Microsoft® Distributed Transaction Coordination (MSDTC):
  - Configured for No Authentication (see appendix for instructions)
- Windows® Firewall Configuration
  - Ensure exclusions for MSDTC
- *TempDB* Configuration
  - It is recommended that TempDB has one Data file per (v)CPU until eight is reached, above eight cores a maximum of eight files should be used unless performance monitoring indicates additional are required.
  - It is recommended that TempDB has only one log file.
  - From eight cores and up the number of tempdb files should default to eight.
  - The IO Wait statistics should be periodically monitored.
    - If PAGEIO_LATCH waits are observed the tempdb files should be split to new disk subsystems (LUN/Physical).
    - If PAGE_LATCH waits are observed additional tempdb files should be added.
- Disk Configuration

- Application **Data** files (MDF) should exist on a separate disk subsystem (LUN/Physical) from the Operating System.
- Application **Log** files (LDF) should exist on a separate disk subsystem (LUN/Physical) from the Operating System, it should be separate from the data files as well.
- TempDB Data Files (NDF) should exist on a separate disk subsystem (LUN/Physical) from the OS, Data and Log Files.
- Example of a properly configured 16 core SQL Server®:

Drive Letter	Disk Usage
C	Windows® OS and SQL Server® Install
G	Descartes Route Planner Data files e.g. LNOSFW_Acme.mdf
H	Descartes Route Planner Log Files e.g. LNOSFW_Acme.ldf TempDB Log Files e.g. tempdb.ldf
I	TempDB Data Files (x4) Tempdb1..4.ndf
J	TempDB Data Files (x4) Tempdb5..8.ndf

- FW_Optimizer_* should always be running
- FW_Scheduler_* should be explicitly not monitored as these services restart on a regular basis as determined by the Optimizer service.

HTTP Monitoring:

- URL: http://[server]/LNOS%20FW%20UI/Core/CtyXmlInterface/DCFListener.asp
- Expected response: <Root>DCF HTTP Listener</Root>

3 Infrastructure

3.1 Redundancy

Due to the critical nature of the Descartes Route Planner application it is recommended that best practice redundancy be implemented. At a minimum it is recommended that the web UI and interfaces servers are in a load balanced cluster for both scalability and redundancy. Depending on the size of the implementation these two classes of servers are put into separate load balanced clusters. At this time "Sticky" connections are required for the web UI cluster and enabling connection persistence by cookie in the hardware load balancer device (e.g. F5 BIG-IP) is recommended. For interface servers, Affinity/Sticky connections are not required and are not recommended as these connections prevent even work distribution.

The database servers should be clustered in an active/passive Microsoft® Cluster Service SQL Server® Cluster. Due to the use of MSDTC the "always-on", "mirroring", etc. clustering technologies are not supported.

SQL Server® Transactional replication is not supported due to the schema changes and limitations on column types. SQL Server® Change Tracking is has not been tested so cannot be supported.

Background Optimizer (BGO) Servers do not require external clustering methods as the application internally manages the load between the available servers, having at least one additional BGO server is recommended to allow for full capabilities in the case of a server failure.

3.2 Servers and Virtualization

At this time, virtualization for the Descartes Route Planner application servers (UI, BIF, BGO) is recommended. The recommended VM Size is four-core and six GB of RAM.

Web UI and Interface servers can be "overloaded" to allow both scalability and redundancy as the usage on these servers varies throughout the day; the workload is "demand based".

When overloading VM's, it is important to plan the size of the VM to the host. In addition Descartes recommends that *no host running Descartes Route Planner be overloaded by a factor of more than two* (e.g. 16 vCPU on a eight core host).

For VMWare and most virtualization software a VM requires access to all physical CPU's simultaneously for all its vCPU. What this means is that a 12 core host running eight core VM's can only have one run simultaneously, when one is working any other eight core VM will have to wait (accumulating ready time).

Each server should have at least 30 GB of disk space allocated in a partition for Descartes Route Planner (excluding operating system). This allocation will provide enough space for two versions of the map files, several versions of the installers and

the application itself. It is recommended that the application is installed on a separate partition from the operating system.

No host should have more than 75 percent of its memory allocated to virtual machines. Exceeding 75 percent has caused noticeable performance degradation to the virtual machine performance in the form of high processor queue lengths. In certain instances hyper-threading has been required to be disabled for similar reasons. As an example a physical host with 16 GB of ram should not have more than 12 GB of memory allocated for virtual machines (e.g. three VM's with 4gb each of six VM's with two GB each, etc).

Each virtual machine should maintain a real-time **%RDY counter less than five percent** or less than 200*(#vcpu) ready summation value for real-time or 3,000*(#vCPU) ready summation value for a daily graph.

3.2.1 Socket:Core Ratio

The **Socket:Core** ratio can have a real-world impact to the performance of the VM. It is recommended to configure this using a ratio of 1:1. Because Route Planner is CPU intensive when performing calculations this can have an impact on the performance. Internet benchmarks show the potential difference could be as much as 15 percent. This has been found to have a noticeable difference for some customers.

As an example a VM with four vCPU should be configured using a configuration of four sockets, one core per socket. The following table illustrates some further examples:

# vCPU	Sockets	Cores	
4	4	1:1	☑
4	2	1:2	☒
4	1	1:4	☒
8	8	1:1	☑
8	2	1:4	☒

3.2.2 VM's Greater than four vCPU

Larger VM's are possible and should maintain a ratio of **1.5 GB RAM per vCPU**. When using larger VM's, the host needs to be scaled up as well. The host should have **at least** 2x the cores of any VM it hosts, this is to ensure there is capacity to host other VM's.

Larger VM's accumulate Ready time faster however Ready Percent is factors this in, as such a %RDY of five percent or lower must be maintained for larger VM's. Certain high performance uses may require a lower %RDY. This is especially true LPS and Reservations.

3.2.3 Virtualization and Background Optimizer (BGO) servers

BGO is very CPU intensive, the **usage pattern is "fully on"**. As long as there is data to optimize each service will use a full vCPU while running. It should not be overloaded with SQL, Descartes AltaMap or other BGO servers unless approved by DSG. Certain business models allow for this to occur but it entirely depends on solution requirements.

IO Latency should be maintained at less than 20ms on average (15 second interval). This can be verified by monitoring the Avg Sec/Read, Avg Sec/Write and Avg Sec/Transfer performance counters.

It is highly recommended that BGO servers have a reserved CPU and memory resources as these servers typically run at > 75 percent CPU usage at all times (24 x 7).

3.2.4 Virtualization and Descartes AltaMap (GM/MAP) servers

Kernal-based Virtual Machine (KVM) is **NOT** supported for virtualizing Descartes AltaMap, through extensive testing it has been determined that it is not a good fit for Descartes AltaMap. It is unable to provide a consistent performance during execution time. The state of the VM at the initial request determines the overall runtime of a request. 50 percent of the time it takes 100 percent longer and 20 percent of the time it takes 200 percent longer for the entire calculation. On large calculations this can equate to very long waits to the Descartes Route Planner servers (five or even 10 minutes of wasted time per request depending on problem size).

See appendix *Descartes AltaMap Performance under* KVM

➲ **Note—** Similar performance problems have been identified using other CPU benchmarking programs.

Descartes AltaMap servers are NOT recommended to be virtualized if used for pathing. If using Descartes AltaMap for geocoding and/or display only this is not a significant concern. A benchmark testing process is required to be completed before approval will be provided for virtualizing Descartes AltaMap for pathing, see *Descartes AltaMap Performance Benchmark* in the appendix for details.

Descartes AltaMap pathing is very CPU, IO and Memory intensive, **the usage pattern is "spiking",** during matrix calculations it will use **all CPU's at 100 percent until finished**. As such it should not be overloaded with SQL, BGO or other Descartes AltaMap servers. The time it takes to complete a pathing call affects the performance of all other aspects of Descartes Route Planner.

To maintain peak performance and **minimize the impact of I/O latency a RAMDisk** (typically 6gb) **must be setup** to hold the map files, this varies depending

on the number of maps used. (Full USA is 5.2gb currently). **This is a 3rd party software package** and is not licensed through Descartes, several vendors are available (e.g. http://www.softperfect.com/products/ramdisk/, http://memory.dataram.com/products-and-services/software/ramdisk).

IO Latency should be maintained at less than 20ms on average (15 second interval). This can be verified by monitoring the Avg Sec/Read, Avg Sec/Write and Avg Sec/Transfer performance counters.

If virtualization is used at this time **Descartes will only support VMWare**, based on limited testing the penalty for virtualization with VMWare is approximately a five percent loss in performance when compared to physical, **assuming no competition to the server resources**. Other virtualization platforms may be able to achieve similar performance however this will require the customer to demonstrate that a consistent performance can be delivered under no load, heavy load and significantly overloaded scenarios using a testing methodology similar to that described in the appendix..

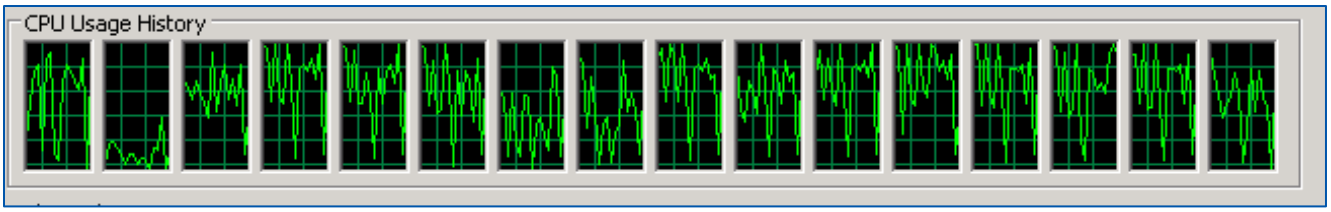
Map servers require a **memory reservation** for their full memory allocation. These servers are very memory intensive and creating a memory reservation improves performance as the server does not have to wait for the host to allocate the required memory to the virtual machine. This memory reservation prevents VMWare from accessing a page file when the server has used up its available memory. Access to the page file significantly slows down the application.

Map servers require a **CPU reservation** of at least 80 percent of the allocated vCPU. This is necessary to ensure consistent performance. This can be done individually or by creating a resource pool in the ESX management this is necessary to ensure consistent performance. If even one server in the pool is slower the entire application will run at the speed of the slowest VM. This is an estimate and can/will vary by customer.

If a CPU reservation cannot be provided dedicated hosts must be used for Descartes AltaMap to ensure there is no competition for the physical CPU's at this point VMWare is essentially being used for its redundancy and failover capabilities and not for any hardware savings.

Map servers require an increased **Shares** value, by default all VM's in VMWare have a value of 1000. This will vary by environment however a value of 10000 is recommended as a base configuration. If 2 VM's are competing for a CPU then the time allocated to each is the ratio of the shares so two VM's with a share of 1000 will get a 50 percent split, if one VM has a share value of 2000 and the other 1000 it will get 66 percent of the CPU time.

The following graph shows the CPU utilization of a typical Descartes AltaMap under load:



3.2.5 Virtualization and SQL

Descartes does **not** recommend virtualizing the SQL Server®, this goes against the Microsoft® best practices and often causes system performance issues.

If however the SQL Server® is virtualized there are a few things that need to be carefully considered:

- Must be configured with memory reservations for the entire memory allocated to avoid delayed memory allocation requests.
- Must be configured with CPU reservations for at least 80 percent of the allocated vCPU to avoid delays in CPU response time.
- In VMWare implementations the shares should be configured with an increased
- An IOPS of 3000-4000 is required for larger implementations.
- IO Latency should be maintained at less than 20ms on average (15 second interval). This can be verified by monitoring the Avg Sec/Read, Avg Sec/Write and Avg Sec/Transfer performance counters.
- SQL VM's should be allocated to hosts in such a way that performance is maintained as equivalent to physical. E.g. vCPU overloading should be minimized.

MSDTC must be uninstalled and reinstalled prior to installation, in many cases the application and SQL Servers® come from the same OS template and have a common MSDTC GUID, this will prevent communication of transaction queries (INSERT, UPDATE, DELETE) from COM+, this can result in services not being registered, data not being able to be imported, etc.

➲ **Note—** You may see an error like this during installation if these steps are not performed:

3.3 Network Stability

Network stability is key to getting consistent performance out of Descartes Route Planner. The individual requirements will vary from customer to customer however the following minimum requirements should be met to ensure a consistent performance from the application. The application will operate at values lower than those listed however it will have a measurable difference in performance, e.g. ping times of 150ms could decrease the performance 10-20 percent. Higher bandwidth can make up for higher latency or vice versa.

Proxy Considerations

- Proxy's can/will decrease the performance of the application.
- Proxy's should never be used between host systems and interface servers.
- Proxy's should never be used between tunnel server and interface servers.
- Proxy's should be assessed regularly to ensure they are capable of handling the increased load.

Full T1 connection to Descartes Route Planner (or higher)

- There is a large amount of dynamic data being passed, a T1 connection is the minimum speed required to ensure the users performance is not significantly impacted.
- More fields being displayed on the dashboard requires more information to be sent, minimizing the number of columns reduces the load on the network.

The network connection should have at least 20-40 percent capacity

- If the connection is too heavily allocated the performance of the application will suffer, this is especially important during peak Descartes Route Planner usage periods.

Latency should be less than 90ms on average

- The results of a ping test should be fairly consistent.
- Erratic ping times should be investigated, as they will lead to erratic slowness in the application

Ping loss should be less than one percent peak periods

- The occasional dropped packet is not unexpected however consistent ping loss indicates an infrastructure problem and can lead to reduced performance of the application
- Dropped packets can lead to users believing the application is "down" when in fact their request was never received by Descartes Route Planner.

HTTP traffic should not have reduced priority

- As Descartes Route Planner is a mission-critical application and is web-based, HTTP traffic to Descartes Route Planner is critical and should not be marked as reduced priority.

- Reduced priority traffic can lead to the same symptoms as ping loss or erratic ping results, the users will encounter slowness or no response at all.

3.4 Load Balancing Configuration

A hardware load balancer dramatically improves the scalability and stability of an Descartes Route Planner environment. Unlike NLB it has the ability to detect if a host is healthy and if it is not it automatically removes it from the pool. This allows the RestartCOM health checks to identify and resolve the issue. When the server is healthy again (passes the configured tests) the load balancer adds the server back to the pool.

A load balancer can identified an issue and react in a significantly reduced period of time. In an NLB environment a person (RP Admin, IT Admin) must first identify the issue, identify the problem host and then either remove it from the cluster or repair it. The time to resolution from initial onset of the problem is approximately 60-120 minutes. With a Hardware load balancer this is reduced to approximately one minute (configured testing interval). Switching from NLB to a hardware load balancer can reduce the number of visible outages by as much as 90 percent.

A hardware load balancer will require two monitoring tasks for Descartes Route Planner:

Basic http check

- Send String of "GET /"
- check for 200 "OK" status
- typically five to 30 seconds between tests

Core http check

- Send String of "GET /[APP]/Core/CtyXMLInterface/DCFListener.asp"
- Expected response: "<Root>DCF HTTP Listener</Root>"
- [APP] is the name of the application being tested:
  - LNOS%20FW%20UI (UI/BIF)
  - LNOSFWUI (UI/BIF if using no spaces installer option)
  - STAD (BIF)
  - RPS (UI only, if installed)
  - Etc
- Minimum interval is 60 sec between tests (less than this can cause stability issues)
- If no response is received, a different response is received or an HTTP error code is received for ANY app on the host the node should be marked as down.

  ➲ **Note—** These tests will verify most conditions when the application can fail but does not cover every situation. This does not verify the ability to perform optimization actions. That is handled through queue monitoring defined later in the document.

Descartes has experience with the F5 BIG-IP device, a configuration guide can be found in the appendix.

3.5 Monitor Alerting

In order to ensure maximum availability of the Descartes Route Planner application the following is recommended as a minimum set of monitoring measures to alert on.

3.5.1 Basic Monitoring

The following Alerts should be monitored:

- When available disk space is less than 10 percent on a drive, send alert
- If two consecutive ping tests fail, send alert
- When CPU usage exceeds 80 percent, send alert. ** This should not applied to BGO Servers
- When memory usage exceeds 80 percent

The following Windows® services should always be running:

- Task Scheduler Service
- Terminal Services Service
- Windows® Time Service
- COM+ Event System Service
- COM+ System Application Service
- World Wide Web Publishing Service
- MSMQ Service
- Workstation Service
- Server Service
- All Automatic Services need to be running and responding

The following performance counters should be monitored:

- Avg Disk Sec/Read (Should be < 20ms)
- Avg Disk Sec/Write (Should be < 20ms)
- Avg Disk Sec/Transfer (Should be < 20ms)

3.5.2 Load Balancer Pool Monitoring:

Generate Alert if all members in a pool are down or if one member in the pool is down for more than 30 minutes (this time is provided as a recommendation only).

3.5.3 Application Specific Monitoring:

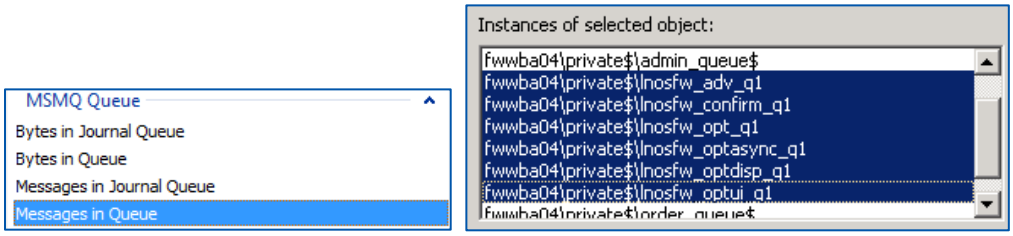
3.5.3.1 Queue Service Monitoring Overview

The various DCF$/LNOS$ services will normally have a scheduled restart once per day, this is usually overnight or during a quiet operations period. For this reason it is a good idea to not alert unless two successive tests fail or to exclude the restart period from monitoring.

The queue services are either prefixed by DCF$ or LNOS$ depending on the version of Descartes Route Planner installed, for monitoring purposes they are equivalent, for simplicity sake the document refers to all services as DCF$.

3.5.3.2 MSMQ queue monitoring

MSMQ Queue monitoring is usually done via performance monitors, these monitors can be identified from the following counter/object: **MSMQ/Messages in Queue**. There will be one instance per queue.



3.5.3.3 Tunnel server/service

Ensure **Descartes MobileLink Tunnel** service is running on one server, this is usually a dedicated VM or a BIF server.

3.5.3.4 UI Servers

UI Operations Monitoring

If possible it is recommended to perform a basic login test using a "replay" monitoring tool that can perform a UI login, perform a series of basic actions and then logout. This should be done every 30 minutes.

A typical test would be:

- Login to the application
- Navigate to data>Schedules menu item
- Locate a specific schedule (typically a test schedule)
- Edit the schedule (double click)
- Click **Save**
- Logout

Specific Service Monitoring

Ensure at least one of each service class is always running.

- DCF$Optimize Svc 1
- DCF$OptUI Svc 1
- DCF$OptAsync Svc 1

Queue Monitoring

Depending on the server size the typical queue monitoring will vary as follows:

- two core server:
  - MSMQ .\private$\lnosfw_optui_q1 – Alert if queue count > 3
  - MSMQ .\private$\lnosfw_opt_q1 – Alert if queue count > 3
  - MSMQ .\private$\lnosfw_optasync_q1 – Alert if queue count > 1
- four core server:
  - MSMQ .\private$\lnosfw_optui_q1 – Alert if queue count > 9
  - MSMQ .\private$\lnosfw_opt_q1 – Alert if queue count > 3
  - MSMQ .\private$\lnosfw_optasync_q1 – Alert if queue count > 2
- eight core server:
  - MSMQ .\private$\lnosfw_optui_q1 – Alert if queue count > 18
  - MSMQ .\private$\lnosfw_opt_q1 – Alert if queue count > 3
  - MSMQ .\private$\lnosfw_optasync_q1 – Alert if queue count > 4

IIS Application pool monitoring

- Ensure the following application pools are always running.
  - LNOSFW

3.5.3.5 BIF Servers

Specific Service Monitoring

- FWBatchProcessor should always be running if configured on server.
- Ensure at least one of each service class is always running.
  - DCF$Optimize Svc 1
  - DCF$OptDisp Svc 1

IIS Application pool monitoring

- Ensure the following application pools are always running.
  - LNOSFW
  - STAD

Queue Monitoring

Depending on the server size the queue monitoring will vary as follows. These values are determined by the number of services allocated to each function. If the number of messages in the queue exceeds the number of (running) services this indicates the request is waiting for a service to process it and should generate an alert.

- two core server:
  - MSMQ .\private$\lnosfw_optdisp_q1 – Alert if queue count > 4
  - MSMQ .\private$\lnosfw_opt_q1 – Alert if queue count > 4

- four core server:
  - MSMQ .\private$\lnosfw_optdisp_q1 – Alert if queue count > 9
  - MSMQ .\private$\lnosfw_opt_q1 – Alert if queue count > 6
- eight core server:
  - MSMQ .\private$\lnosfw_optdisp_q1 – Alert if queue count > 18
  - MSMQ .\private$\lnosfw_opt_q1 – Alert if queue count > 9

3.5.3.6 BIF (Reservations) Servers:

Specific Service Monitoring:

Ensure at least one of each service class is always running.

- DCF$Adapi Svc 1 (adapiExec1)
- DCF$Confirm Svc 1 (confirmExec1)

IIS Application pool monitoring

Ensure the following application pools are always running.

- LNOSFW
- STAD

Queue Monitoring

Depending on the server size the queue monitoring will vary as follows.

- two core server:
  - MSMQ .\private$\lnosfw_adv1_q1 – Alert if queue count > 2
  - MSMQ .\private$\lnosfw_Confirm_q1 – Alert if queue count > 3
- four core server:
  - MSMQ .\private$\lnosfw_adv1_q1 – Alert if queue count > 6
  - MSMQ .\private$\lnosfw_Confirm_q1 – Alert if queue count > 9
- eight core server:
  - MSMQ .\private$\lnosfw_adv1_q1 – Alert if queue count > 12
  - MSMQ .\private$\lnosfw_Confirm_q1 – Alert if queue count > 18

3.5.3.7 BGO Servers

Queue Monitoring

Depending on the server size the queue monitoring will vary as follows.

- four core server:
  - MSMQ .\private$\lnosfw_opt_q1 – Alert if queue count > 6
- eight core server:
  - MSMQ .\private$\lnosfw_opt_q1 – Alert if queue count > 9

3.6 SQL Server® Monitoring

3.6.1 SQL Server® Performance Counters

The following performance counters should be regularly monitored and reviewed on the SQL Server®:

- CPU: % User Time
- System: Processor Queue Length
- Memory: Hard Pages/Sec = Pages Input/sec
- Memory: Soft Pages/Sec = Page Faults/sec – Pages Input/sec
- Physical Disk: Avg Disk Queue Length
- Physical Disk: Current Disk Queue Length
- Physical Disk: Avg Sec/Read, < 20ms
- Physical Disk: Avg Sec/Write, < 20ms
- Physical Disk: Avg Sec/Transfer, < 18ms
- Process: Thread Count
- Process: Context Switches/Sec
- MSSQL: Full Scans/sec
- MSSQL: Index Searches/sec
- MSSQL: Buffer Cache hit ratio
- MSSQL: Transactions/sec
- MSSQL Latch: Average Wait Time
- MSSQL Lock: Average Wait Time
- MSSQL Lock: Requests/sec
- MSSQL Lock: Timeouts/sec
- MSSQL Lock: Deadlocks/sec
- MSSQL Buffer Manager – Page life expectancy
- MSSQL General Statistics – User Connections
- MSSQL Memory Manager – Memory Grants Pending
- MSSQL SQL Statistics – Batch Requests/sec

3.6.2 Database Blocking Test

A process needs to be setup to look for processes that cause blocks to other processes for extended periods of time. This blocking can lead to general slowness or unresponsiveness. It is recommended to setup a process that looks for these and alerts if it is over a certain threshold.

See appendix for stored procedure code.

➲ **Note—** This requires the creation of a DBAStats database.

3.6.3 SQL Table Monitoring

In addition to the service monitoring there are certain tables worth monitoring as well.

3.6.3.1 FWOptTask (Batch Processor Queue)

The batch processor stores its queue of tasks within the SQL database, if this queue is too old it means either the batch processor is not running or is not able to keep up, either due to problems with other services (DCF$Opt/LNOS$Opt) or because there are not enough threads configured.

The FWOptTask table is contained within each "FW" database (e.g. LNOSFW_xxx or FWxxx). If this queue grows too large then routes will not be recalculated when orders are updated or deleted which can cause problems with BGO and dispatcher/planners ability to review routes. In earlier version of Descartes Route Planner deletes are actually executed by the batch processor so if it is not working no orders will be deleted.

```
use LNOSFW_xxx
declare @MaxAttempts int
set @MaxAttempts=3 -- default is 3
SELECT Count(CASE
               WHEN AttemptCount < @MaxAttempts+1 THEN ModifyDate
               ELSE NULL
             END)                          [QueuedMessages],
       Datediff(n, Min(CASE
                         WHEN AttemptCount < @MaxAttempts+1 THEN ModifyDate
                         ELSE NULL
                       END), Getdate()) [MinAgo],
       Sum(CASE
             WHEN AttemptCount > @MaxAttempts+1
                  AND ModifyDate > Dateadd(hh, -1, Getdate()) THEN 1
             ELSE 0
           END)                          [FailuresInLastHour]
FROM   FWOptTask (NOLOCK)
```

In the query above the alert threshold will usually be based on the **MinAgo** with a reasonable limit of 15 minutes.

The **Attempt Count** is configurable. However, the default is three attempts and only alerts on those waiting to execute are wanted.

Another useful piece of information is **FailuresInLastHour**, if this number is high it could point to environmental problem or problems related to a recent upgrade (bug).

➲ **Note—** The task query should be executed on a reasonable interval (e.g. 15 min), the earliest an alert could be raised would be the MinAgo threshold + Frequency interval (e.g. if both are 15 minutes then the earliest an alert could be raised would be 30 min).

3.7 Microsoft® Patches

In order to maintain the security of the LNOS environment it is important that patches be regularly applied to servers. It is recommended that patches be deployed into a test environment less than one week after being released (typically 2nd and sometimes 4th Tuesday of each month). Most patches can be promoted to production within a few days however certain patches may require extra testing.

The extra testing patches are outlined according to product below:

- Microsoft® Windows®
  - Service Packs
  - Changes to vbscript.dll (used by ASP to render the webpage)
  - Internet Information Services (IIS)
- Microsoft® SQL Server®
  - Service Packs

3.8 Disaster Recovery Planning

Disaster planning is an important step in any enterprise solution. The following section outlines some general guidelines on defining a disaster recovery plan for Descartes Route Planner. The disaster recovery strategy will vary depending on the type of server in the solution as well as acceptable RPO/RTO.

In general, a disaster site could represent a subset of the production site if desired. In that case, it is important to work with the Descartes Professional Services team to determine what is an acceptable loss of scale as well as functionality at the disaster site (e.g. longer BGO optimization or none at all, no +1, merging of server roles).

3.8.1 "LNOS" Servers (User Interface, Reservations/BIF, BGO)

All three of these servers can be handled in the same fashion. Generally speaking, these servers do not have any application "data" on them. Local and environment-specific configuration allows the server to know which SQL Server® to communicate with. The majority of these configuration items are static; once configured, they do not tend to change.

If these servers are virtualized (recommended) virtual machine replication can be used to synchronize to the remote site. If this approach is used, then the SQL Server® name must not change between primary and disaster database. This can be achieved through the use of a DNS alias if required. If the SQL Server® name

changes, this will invalidate the license and will invalidate the configuration of the servers.

If virtual machine replication is not an option (e.g. physical servers), then the servers will need to be manually synchronized. This would generally be achieved by installing the application at the disaster site, applying any upgrades/patches in parallel or slightly delayed to production and by copying the configuration settings.

The criticality of the different servers is variable depending on the deployment but generally speaking, BIF servers are critical and UI servers can usually be scaled down. The BGO can vary significantly depending on the requirements. However, if the BGO is under sized, this could cause more load on the UI servers as the users will be performing operations done by the BGO servers.

Configuration files can be found at:

- [drive]:\Inos\fleetwise\scheduler\conf\[service]*.properties
- [drive]:\Inos\LNOSFWBatchProcessor*.config
- [drive]:\inetpub\wwwroot\LNOSFWUI\GeneratedFiles\config.xml
- [drive]:\inetpub\wwwroot\STAD\GeneratedFiles\config.xml

Registry settings can be found at:

- HKLM\Software\[*Wow6432Node*\]Descartes ← application config
- HKLM\Software\[*Wow6432Node*\]DCF ← installer and RestartCOM

3.8.2 "Descartes AltaMap" Servers (Tiling, ME, LPS, RMWS)

Some Descartes AltaMap servers are usually virtualized (Tiling, ME, LPS). The RMWS is typically physical due to performance requirements. The LPS and RMWS servers are critical to the operation of the application when utilized. If undersized, the entire application performance will be affected.

The strategy for each server type is different:

Tiling

- Required when not using an external tiling solution
- The server name does not matter as it is typically accessed through a load balancer.
- If not present the application *will still function*, however no map will be displayed to the users. Routes can still be seen but on a white background.
- **Wwwroot\TilingService\Web.config** has some static configuration settings, not environment specific.

LPS

- Only exists when External Pather is enabled.

- The server name matters. If changed it will invalidate the application configuration in several places.
- *Critical to operations.*
- **wwwroot\PathingService\Web.config** contains critical configuration settings. These settings are environment specific (list of servers to communicate with). If the servers in the DR site have different names it will need to be updated if replicated.
- **wwwroot\PathingService\GeneratedFiles** folder contains a cache file, this hour represents potentially hours of work and if lost the system performance will significantly degrade. This file should be replicated to the disaster recovery site daily or even hourly depending on how much customer change there is day over day. These files can be several gigabytes. It also contains any published map edits that have been cached which are also critical to the operations, if they change the entire cache is rendered invalid.
- If desired, External Pather can be disabled in a disaster recovery site, but this configuration could result in different routes being produced that are potentially infeasible. Legacy mapping (LMB) will be used instead.
  - Disable External Pather for backend: **App Setup > System Values**, Set UseExternalRoadRouter = 0
  - BGO, per service:
    - Edit [drive]:\lnos\fleetwise\scheduler\conf\[service]\local.properties
    - Set UseExternalRoadRouter = 0

  ➲ **Note—** These settings are cached.

Map Editor

- Only exists when External Pather is enabled.
- The server name matters. If changed, the server name needs to be updated in the LPS web.config.
- This server is *optional*. If not present at the disaster recovery site, LPS will use the cached edits.
- **wwwroot\MapEditor\Web.config** contains critical configuration settings
- **wwwroot\MapEditor\GeneratedFiles** folder contains map edits that are critical to the use of the system.

RMWS

- Only exists when External Pather is enabled.
- *Critical to operations.*
- The server name matters. If changed, the server name needs to be updated in the LPS web.config.
- This server is *Required*.
- Configuration is not environment specific.

- **wwwroot\RMWS\web.config** contains install related configuration settings only.

  ➲ **Note—** Can be virtualized in disaster recovery site if physical in production.

SQL Server

Descartes Route Planner depends on MSDTC to manage transactions between the various databases. As such this limits what high availability options are available.

The recommended strategy is to use log shipping to a target SQL Server® and use a DNS alias or hosts entries at the DR site to avoid invalidating the license/configuration.

4 Application Health Maintenance

4.1 AntiVirus Exclusions

Anti-virus software should be configured with the appropriate exclusions to avoid performance problems with Descartes Route Planner, certain tasks are sensitive to I/O performance and AntiVirus can add significant latency to these tasks.

The recommended exclusions are:

- By Folder
  - LNOS:
    - [app]:\Maps
    - [app]:\inetpub\wwroot\LNOS FW UI\GeneratedFiles
    - [app]:\lnos\fleetwise\cache
    - [app]:\lnos\fleetwise\scheduler\conf
  - RMWS:
    - [app]:\Data (map files)
- By Process
  - DCFProcessSvc.exe
  - Tomcat.exe
  - Scheduler.exe
- By File
  - *.lmb
  - *.ld?
  - *.le?
  - *.log
  - *.prp
  - *.dcf
  - *.gcx
  - *.def
  - *.amg
  - *.box
  - *.emf
  - *.lps
  - Pagefile*.sys
- From Microsoft®
  - See http://support.microsoft.com/kb/822158
  - In Summary:
    - wsusscn2.cab
    - package*.cab
    - %windir%\SoftwareDistribution\Datastore\

- %windir%\SoftwareDistribution\Datastore\Datastore.edb
- %windir%\SoftwareDistribution\Datastore\Logs\Edb*.log
- %windir%\SoftwareDistribution\Datastore\Logs\Edb.chk
- %windir%\SoftwareDistribution\Datastore\Logs\tmp.edb
- %windir%\SoftwareDistribution\Datastore\Logs\Edbres00001.jrs
- %windir%\SoftwareDistribution\Datastore\Logs\Edbres00002.jrs
- %windir%\security*.edb
- %windir%\security*.sdb
- %windir%\security*.log
- %windir%\security*.chk
- %windir%\softwaredistribution*.cab
- %windir%\system32\ccm\cache*.cab
- %windir%\SoftwareDistribution\Datastore\Logs\res1.log
- %windir%\SoftwareDistribution\Datastore\Logs\res2.log
- %windir%\security\database*.sdb

4.2 Antivirus Agent configurations

Many anti-virus corporate utilities deploy an agent on each machine, in order to communicate with the management center a port is typically used, some agents default to use the same port as BGO (e.g. mcafee ePO). This can result in the BGO scheduler service to terminate as soon as the optimizer starts (as it cannot connect). The BGO uses ports 808# where the # is determined based on the service number (0-based list, e.g. 8080).

4.3 Descartes Route Planner

4.3.1 RestartCOM Overview

Descartes Route Planner has several built-in health-check functions contained in the RestartCOM utility. The installer automatically creates these tasks as Windows® scheduled tasks on each server when first installing Descartes Route Planner, these tasks should be reconfigured as needed for the local environment.

4.3.2 RestartCOM Task

This task should run daily at a time that will not interfere with production activity. It is recommended to stagger the time for similar class servers so not all servers are down at the same time. This task will restart all application and OS level components used by the application to ensure optimal performance.

4.3.3 TestDCFFrontend

This task should run at most every 10 minutes and at least once per hour, typically runs every 30 minutes. The execution time should be staggered with CheckDCFBackend to ensure the two tasks do not interfere with each other. This task checks the application pools for each installed application and will recover them if an issue is detected

The Timeout limit should be configured to something reasonable

HKLM\Software\DCF\RestartCOM\RestartTimeOut, recommended value is 45000 (45 sec).

4.3.4 TestDCFBackend

This task should run at most every 10 minutes and at least once per hour, typically runs eveyr 30 minutes. The execution time should be staggered with CheckDCFFrontend to ensure the two tasks do not interfere with each other. This task checks the backend component and will recover the component if an issue is detected. This is a "lighter" test then CheckDCFBackend.

The Timeout limit should be configured to something reasonable

HKLM\Software\DCF\RestartCOM\RestartTimeOut, recommended value is 45000 (45 sec).

4.3.5 TestDCFServices

This task should run at most every 10 minutes and at least once per hour, typically runs every 45 minutes. This task checks the virtual bytes memory usage of each DCF* and FW* service, if the service is over the configured limit it restarts only the problem service(s), individually. The memory limit is configured in the registry at HKLM\Software\DCF\RestartCOM with the MemoryUsagePercentage string. The installer defaults to 20 (percent).

The following table provides the recommended configuration by server size:

Total Memory	UI Registry Configuration	BIF Registry Configuration	BGO Registry Configuration
2 GB	20	20	20
3 GB	12	12	20
4 GB	10	8	20
6 GB	8	6	20
8 GB	5	4	15
12 GB	4	3	10
16 GB	3	2	8

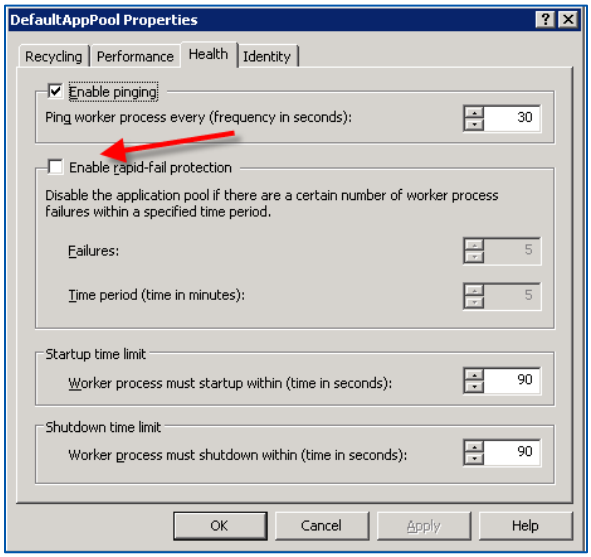
4.3.6 TestDCFMsmq

This task should be disabled.

4.3.7 IIS Post-Install configuration

4.3.7.1 Configure Descartes Route Planner App Pool Properties

For all application pools disable "Rapid-fail protection"



4.4 ESX Monitoring

4.4.1 Performance Counters

When virtualizing it is possible to overload the host, if a host is significantly overloaded this can lead to application freezing or slow performance where the guest operating system shows high CPU usage even though the application is not significantly using the CPU.

To monitor for an excessively overloaded host the %RDY ESX host performance counter should be monitored, a warning should occur if it exceeds five percent and an alert if it exceeds 10 percent.

4.5 Database Scheduled Tasks

4.5.1 Security Cleanup

Recommend to run daily or weekly by calling the dsg_CleanupSec stored procedure in the DCFSec databases. The parameter provides the number of days to retain.

See appendix for source code.

4.5.2 FW Cleanup

Recommend to run daily or weekly by calling the dsg_CleanupFW stored procedure in the LNOSFW database. The parameter provides the number of days to retain.

4.5.3 Backups (and Recovery Model)

A regular backup schedule should be implemented, below is the recommendations by backup type. The backups should be saved to a non-local disk or backed up to non-local disk regularly otherwise in the case of failure the backups may not be available for recovery.

The / in the table below represents two options, e.g. DCF can be Full weekly and Diff daily OR Full daily.

Database	Recovery Model	FULL	DIFF	TLOG
DCF	Simple	Weekly/Daily	Daily/NA	N/A
DCFSec	Simple	Weekly/Daily	Daily/NA	N/A
DCFSec_xxx	Simple	Weekly/Daily	Daily/NA	N/A
DCFSec_xxxArchive	Simple	Weekly/Daily	Daily/NA	N/A
LNOSFW	Full	Weekly/Daily	Daily/NA	Hourly
LNOSFW_xxx	Full	Weekly/Daily	Daily/NA	Hourly
LNOSFW_xxxArchive	Full	Weekly/Daily	Daily/NA	Hourly/NA
ShipperTAD	Simple	Weekly/Daily	Daily/NA	N/A
ShipperTAD_xxx	Simple	Weekly/Daily	Daily/NA	N/A
ShipperTAD_xxxArchive	Simple	Weekly/Daily	Daily/NA	N/A
SessionServer	Simple	Weekly	NA	NA
LNOSLic	Simple	Daily	Hourly	Hourly

4.5.4 Reindex

Recommend to run daily or weekly as needed. This can be done by executing the **Reindex_all_table** stored procedure in each database. No parameters are required. Due to the nature of the Descartes Route Planner transactions certain tables (fwstop, fwactivity, fworderline fwactivitywindow) fragment extremely quickly and if indexes

are not maintained can cause sub-second queries to run in the five to 10 seconds or even minutes depending on the fragmentation levels.

4.5.5 SQL Statistics

A manual update of the table statistics on a weekly basis is recommended. Similar to the reindexing, this update is necessary to maintain optimal performance of the application.

4.5.6 Old Locks Cleanup

➲ **Note—** this task is not required starting in Descartes Route Planner 13.1.x

It is recommended to run this task every 15 minutes, any locks older than two hours will be removed. This prevents old locks from impacting operations (preventing optimize all or other transactions). This task is executed in the LNOSFW databases (LNOSFW, LNOSFW_xxx).

Example:

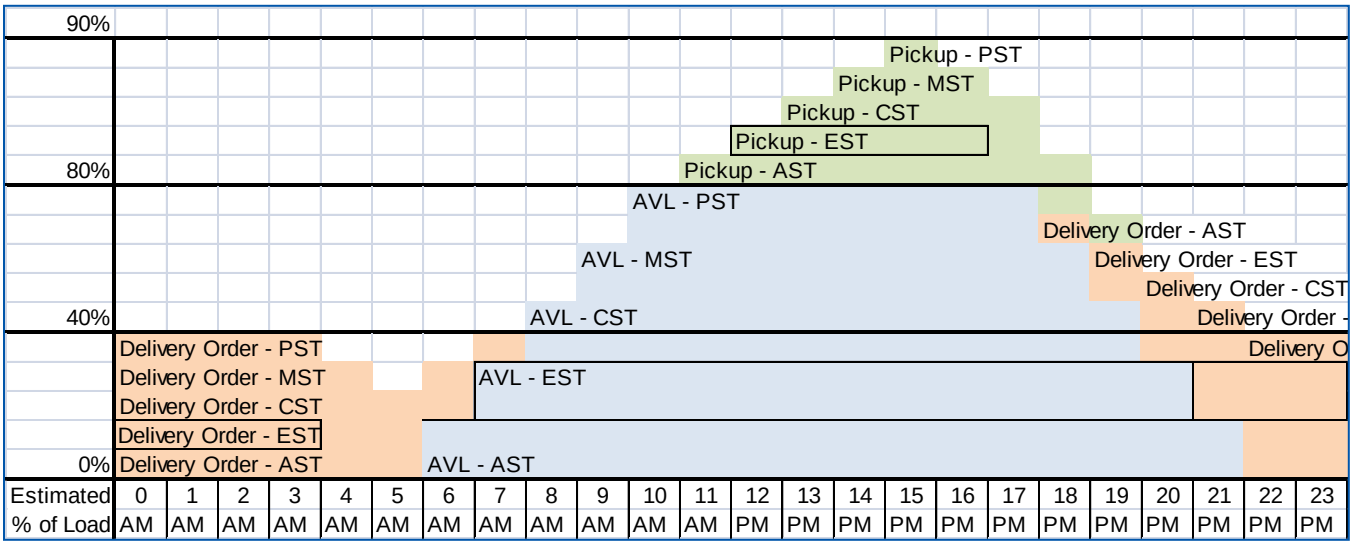
```
--Delete locks older than 2 hours

delete from FwOptLockStatus

where datediff(n,Modifydate,getdate()) > 120
```

5 Application Systems Overview

5.1 BIF Server Profile

The following profile gives a rough estimate on the expected usage profile of an interface server. This is provided purely as a means to show the relative workload of the server and should not be used as a hard estimate on the CPU requirements throughout a day as these numbers will vary based on actual usage.

In the example below there are mobile activities (AVL) occurring between 6AM-9pm server time, delivery orders are being imported between 6pm-7am and pickup orders are being imported between 11am-7pm. The import is staggered by timezone and the peaks occur when all timezones activities coincide.



5.2 Network usage requirements

Here are the raw statistics from IIS for a single day with 12 planners and six dispatchers:

Hour	Sent KB/Hr	Recv KB/Hr	Sum of posts
9	5.3	891.0	15
10	4.2	1,321.2	12
11	38.7	15,608.6	210
12	841.8	260,242.2	2374
13	1,185.7	314,521.8	2716
14	1,094.3	345,085.8	3395
15	1,547.2	471,525.4	5238
16	1,406.7	376,048.9	4762
17	917.1	212,358.9	2851
18	1,325.1	315,284.6	3931
19	1,528.1	328,964.8	4039
20	865.3	284,213.1	2535
21	150.0	91,393.1	691
22	108.6	77,824.3	537
23	64.8	72,597.6	382
Total	**11,083.0**	**3,167,881.2**	**33688**

Based on an analysis of 12 planners and six dispatchers the bandwidth requirements are:

- 250-350mb/hr and typically one hour per day this increases to 450-500mb/hr
- For 18 users the average number of users performing an operation per minute during peak period is 7 (40 percent).
- They will perform approximately 3k-5k clicks per hour
- Each click will return 100k of data on average.

➲ **Note—** It is believed that these numbers represent after IIS compression however this is not confirmed.

5.3 SQL Server® Requirement Details and Performance Summary

5.3.1 Databases Required and Naming Conventions

Descartes Route Planner has several application databases, a few databases repeat for each "Organization", the others only exist per application environment. It is highly recommended that the database names be left alone for supportability however if required most can be modified by adding a **Prefix only** and some can be renamed entirely. Organizations (and their associated databases) are created through the application installer (LNOSSetup).

➲ **Note—** the Archive databases are recognized as such by the convention of **[ParentOrg]Archive**.

Database	Renaming?	Purpose	Typical Size
DCF	Prefix only	Environmental and application metadata.	1GB
DCFSec	Prefix only	Security information for data in the "Application" databases (LNOSFW,ShipperTAD, etc) for the **Default/Template** organization (FW). New DCFSec databases are created from this database.	1-5GB
DCFSec_xxx	Prefix only	Security information for data in the "Application" databases (LNOSFW,ShipperTAD, etc) for the **xxx** organization	1-5GB
DCFSec_xxxArchive	Prefix only	Security information for data in the "Application" databases (LNOSFW,ShipperTAD, etc) for the **xxx** organization's archive database.	1-5GB
LNOSFW	Prefix only	Application database containing the routing data for the **Default/Template** organization (FW). New LNOSFW databases are created from this database.	1GB
LNOSFW_xxx	Prefix only	Application database containing the **routing data** for the **xxx** organization.	1-20+ GB
LNOSFW_xxxArchive	Prefix only	Application database containing the ***Archive*** routing data for the **xxx** organization.	1-50+ GB
ShipperTAD	Prefix only	Legacy application database for the **Default/Template** organization (FW). New ShipperTAD databases are created from this database.	1GB
ShipperTAD_xxx	Prefix only	Legacy application database for the **xxx** organization.	1GB
ShipperTAD_xxxArchive	Prefix only	Legacy application database containing the ***Archive*** data for the **xxx** organization.	1GB

SessionServer	Simple	User session database, used to maintain session details in case of server failover on UI servers.	1GB
LNOSLic	Simple	License data for the application is stored here.	1GB

5.3.2 Database Creation

The Databases are created by the LNOSSetup utility during installation of the application. The database files are created in the *default* SQL Data and log paths but can be moved after creation.

5.3.3 Database Schema

The database schema must not be modified in any way, moving tables between SQL files group, etc is not supported and may break the installation and future upgrade processes.

Indexes can be added however these indexes could prevent the installer from working if they have the same name as new application schemas. As such it is recommended that these custom indexes be prefixed with the organization name. Custom indexes should be reviewed by Descartes to ensure they will not negatively impact application performance and should be re-reviewed for necessity after each upgrade.

5.3.4 MSDTC

MSDTC is a fundamental component of the COM+ architecture when using COM+ transactions. Descartes Route Planner uses COM+ transaction and as such MSDTC must be installed and appropriately configured on the SQL Server®. The application cannot function without it.

See section 2.3.4 Microsoft® Distributed Transaction Coordinator (DTC) for more details on setup requirements.

5.3.5 Performance characteristics

- **Transactions per second**
  - 15-30 during peak period is a rough estimate based on existing clients
- **Read/Write ratios**
  - Descartes Route Planner (FW) database:
    - Read ratio: 96 percent Data File (1.4 mil)
    - Write ratio: 70 percent Log File (9.5 mil)
    - Data file: 74 percent Write (4.15 mil)
    - Log File: 99 percent Write (9.49 mil)
- **Security Database:**
  - Read ratio: 98 percent Data File (0.15 mil)

- Write ratio: 78 percent Log File (0.15 mil)
- Data file: 75 percent read (0.15 mil)
- Log File: 98 percent Write (0.15 mil)

- **I/O Rates**
  - A customer servicing ~two million orders per year will generate the following I/O requirements
    - 220k/read ~12/sec
    - 22k/write ~43/sec
    - 60k/transfer ~?/sec
- **Peak and average # of user connections**
  - This is highly dependent on the number of servers and users. Each COM+ instance and LNOS/DCF$ service running on each server can create one or more connections
  - Connection pooling is used.

5.3.6 Database profile

- Number of tables in each database (based on the 12.x release):
  - DCF: 150
  - FW database: 98
  - Sec database: 88
- Number of Stored Procedures in each database (based on the 12.x release):
  - DCF: 54
  - FW database: 53
  - Sec database: 43

Authentication type

- Mixed – Descartes Route Planner requires both SQL and Windows® based authentication
- SQL authentication is no longer required with Descartes Route Planner v15.x

Database users

- Domain account used as the service
  - Domain Service Account
- TMOSystem account used as the database Owner account
  - SQL Server® Login
- Session server account
  - SQL Server® Login
  - Required for load balanced UI servers

- Can be a dedicated account, requires only DBO after database creation.

5.3.7 Growth Rate

The size of the database and growth rate will be determined by the retention period desired. If pictures/signatures are used the database growth will be significantly faster depending on the number of pictures being taken these pictures are stored in the FWFieldData set of tables.

DCF and Sec databases have minimal growth, DCF database is primarily static. Sec database grows with acquisitions however is typically small. The sec database also has "trace" messages, based on two months messages for a comparable size organization it will be approximately one to two gigabytes. Purging application trace logs after 30 days using the dsg_CleanupSec stored procedure provided in the hosting guide appendix is recommended.

Based on a **LNOSFW_xxx**(Archive) database with the following profile the size is ~10 GB, here are top tables by size:

Table Name	# Records	Reserved (KB)	Data (KB)	Indexes (KB)
dbo.FWRouteHist	4,546,141	1,980,104	1,791,416	187,760
dbo.FWStop	1,804,493	1,701,464	1,249,288	447,912
dbo.FWOrderLine	2,368,700	1,482,128	1,225,184	254,384
dbo.FWActivity	1,360,459	1,088,560	754,704	330,240
dbo.FWOrder	1,360,459	940,360	863,296	75,952
dbo.FWGPSStatus	4,606,182	715,584	465,344	249,336
dbo.FWActivityWindow	1,359,644	324,832	305,504	18,344
dbo.FWResource	190,933	313,168	285,704	24,224
dbo.FWLocation	252,471	246,320	229,368	15,992
dbo.FWRoute	190,933	146,656	110,992	33,976

A calculator is available through our services team to estimate the database size/growth rate.

Miscellaneous Q&A

Are SQL file groups required?

No, they are **not** supported.

Are database application or user roles required?

No.

Will there be any SSIS?

No.

Will there be any replication?

Not an application requirement

Recommended Collation Settings:

SQL_Latin1_General_CP1_CI_AS

Is database level auditing required?

Not required by the application but may be required for other reasons (e.g. policy).

5.3.8 SQL Server® Service

The SQL Server® must run under an account that has access to network shares on the applications servers during the install process. During the install the SQL Server® needs to create a network share to the installation server to create the initial databases.

If using *UIFUsageStats* database the SQL Service account must have access to the temp storage folder used to import IIS logs into SQL.

5.3.9 TempDB

See Server Software/Hardware requirements *Database Server (Database, SQL)*.

5.3.10 Data and Log Files

It is recommended that the data and log files should be placed on separate disks/LUNs. The Data file as describe previously is primarily read, the log file is nearly 100 percent write. Doing so allows the optimization of the disk performance and allows for the SAN to be configured based on this read/write ratio to improve I/O performance.

- Special security or role requirements? (SA, DBO, etc...)
  - SysAdmin required on upgrade/install, DBO required for execution
- Collation/sort order requirements
  - SQL_Latin1_General_CP1_CI_AS
- Special backup requirements?
  - Simple for DCF database
  - Full for Descartes Route Planner databases (e.g. LNOSFW, LNOSFW_xxx)
  - Simple for Security databases (e.g. DCFSec, DCFSec_xxx)
  - Simple for License database
- Protocols required (TCPIP, named pipes)
  - TCPIP
- Are any other supporting roles required (analysis, Integration, Replication, Reporting, Notification, Service Broker, full-text search, etc...)
  - No.

6 Security

The following section outlines best practices related to the security of the Descartes Route Planner application and the servers hosting Descartes Route Planner.

6.1 Application Logins

6.1.1 User Logins

Historically password complexity and history rules are not enabled, however as a best practice these should be configured.

These can be enabled by logging in as [Organization]/[Organization]-secadmin/cs

➲ **Note—** for standalone installs the username is always fw-secadmin

Navigate to **Setup>Profile Items**, filter for category **Password Management**.

Right click the desired configuration item and choose **Add Org Item** or **Edit Org Item**.

Category	Key	Value(s)
Password Management	Psw - Minimum Length	
Password Management	Psw - Blank Allowed	
Password Management	Psw - Num Char Types Required	
Password Management	Psw - Change Every x Days	
Password Management	Psw - Num Prior Passwords Kept	
Password Management	Psw - FailedLoginsBeforeLockout	

The recommendation configuration values are:

- Minimum Length = 7
- Blank Allows = False
- Num Char Types Required = 3
- Change Every x Days = 30
- Num Prior Passwords Kept = 3
- Failed Logins Before Lockout = 3

6.1.2 Interface Logins

Interface accounts should use a complex password.

Each interface or tool (e.g. BGO, Batch Processor, DocBOL, MoveSchedule, etc) should use a separate account, this provides better change tracking and security. It also limits the scope of a compromised password.

After creation the PswNeverExpires column should be set to 0 in the database manually this can be done using the following query:

```
use Sec[Organization]
update CtyUser
set PswNeverExpires=0
where LoginName='xxxx'
```

➲ **Note—** If this is a standalone installation the database name will usually be DCFSec_[Organization]

6.1.3 Organization Default Logins

The default logins should have their passwords updated and should be avoided for day to day operations, this is because they provide no context as to who is doing the work. Unneeded accounts can be disabled.

Here is the list of default logins created by Route Planner:

- [Organization]-FWAdmin | FW-Admin
- [Organization]-FWPlanner | FW-Planner
- [Organization]-FWDispatcher | FW-Dispatcher
- [Organization]-FWReadonly | FW-Readonly

6.1.4 Security Logins

The security logins should have their password updated. Additional accounts cannot be created so these account details should be shared sparingly.

6.2 IIS/Server Configuration

- Enable HTTPS
  - As a best practice Server-Side SSL should be configured even for non-hosted customers to ensure all communication is encrypted.
- Configure X-Forwarded-For logging
  - If using a load balancer (e.g. F5 Big-IP) custom logging should be enabled to capture the X-Forwarded-For header field.
  - This can be done via the following powershell command:

```
New-ItemProperty 'IIS:\Sites\Default Web Site' -Name
logfile.customFields.collection -Value @{logFieldName='OriginalIP';
sourceType='RequestHeader'; sourceName='X-FORWARDED-FOR'}
```

- Disable SSL v2/3
  - Locate the following registry key:
    - HKLM:\System\CurrentControlSet\Control\SecurityProviders\SCHANNEL\Protocols
  - Update/create childkeys “SSL 2.0” and “SSL 3.0”
  - Update/create DWord property Enabled with a value of 0

- This can be done via the following powershell command:

```
$SSLProtocols = Get-Item
HKLM:\System\CurrentControlSet\Control\SecurityProviders\SCHANNEL\Protocols
$SSL3Key = New-Item -Name 'SSL 3.0' -Path $SSLProtocols.PSPath -Force
$SSL3KeyEnabled = New-ItemProperty -Name 'Enabled' -Value '0' `
                    -PropertyType "DWord" -Path ($SSL3Key.PSPath) -Force
$SSL3keyServer = New-Item -Name 'Server' -Path $SSL3key.PSPath -Force
$SSL3keyEnabled = New-ItemProperty -Name 'Enabled' -Value '0' `
                    -PropertyType "DWord" -Path ($SSL3keyServer.PSPath) -Force
```

6.3 SQL Server

The installer account (e.g. install_user) requires the following permissions to install:

```
GRANT CREATE ANY DATABASE TO install_user
EXEC sp_addrolemember N'db_owner', install_user
alter user install_user with default_schema = dbo
```

Warning— Default schema cannot be configured for permissions granted at the group level.

The application account (e.g. TMOSystem) requires the following permissions to run:

```
sp_addrolemember 'db_ddladmin', tmosystem
sp_addrolemember 'db_datareader', tmosystem
sp_addrolemember 'db_datawriter', tmosystem
alter user tmosystem with default_schema = dbo
grant execute on schema :: dbo to tmosystem
```

6.4 ADFS SSO configuration

The **web.config** for the application directory should be modified to include in any production environment (although it would be a best practice to configure in test/dev as well for security reasons):

```
<customErrors mode="RemoteOnly" />
```

This should be placed under the **system.web** node; this will be addressed in a future installer.

```
<configuration>
  <!-- …snip… -->
  <system.web>
    <authorization>
      <deny users="?" />
    </authorization>
    <authentication mode="None" />
    <compilation defaultLanguage="c#" debug="false">
      <assemblies>
        <add assembly="Descartes.CoreUI.Web, Version=12.1.1.1, Culture=neutral,
PublicKeyToken=43deb8f167c0b959" />
        <add assembly="Descartes.CoreUI.Web.Application, Version=12.1.1.1, Culture=neutral,
PublicKeyToken=643ec2d026659120" />
        <add assembly="FedSSO, Version=12.1.1.1, Culture=neutral,
PublicKeyToken=9ea4b23f98029da1" />
        <add assembly="Microsoft.IdentityModel, Version=3.5.0.0, Culture=neutral,
PublicKeyToken=31BF3856AD364E35" />
      </assemblies>
    </compilation>
    <customErrors mode="RemoteOnly" />
    <!--Commented out by FedUtil-->
    <!--<authentication mode="Windows" />-->
    <!--Commented out by FedUtil-->
    <!--<authorization><allow users="*" /></authorization>-->
    <trace enabled="false" requestLimit="10" pageOutput="false" traceMode="SortByTime"
localOnly="true" />
    <!-- …snip… -->
  </system.web>
  <!-- …snip… -->
<configuration>
```

7 Appendix

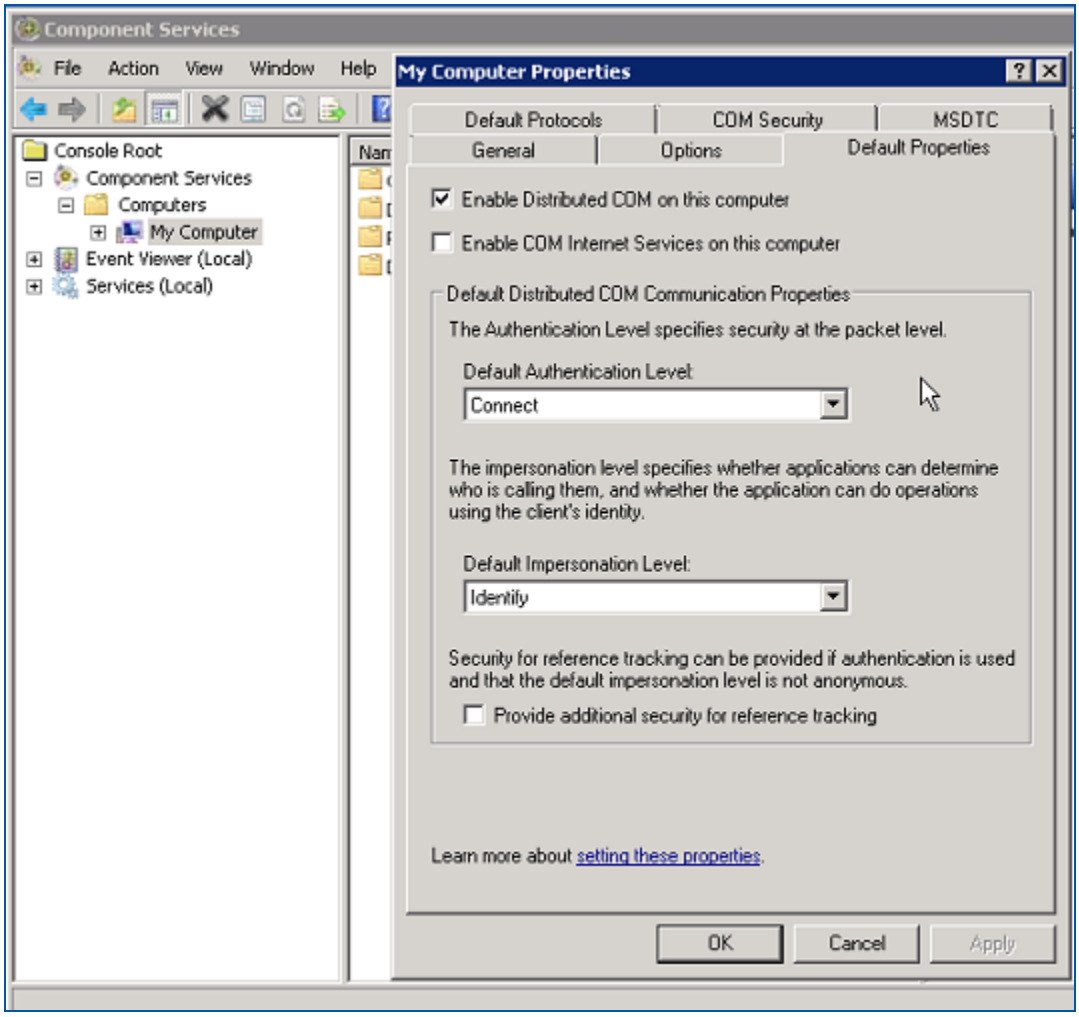
7.1 Windows Server® 2008/2012/Windows® 7 (PC) MSDTC setup

MSDTC needs to be configured for "No Authentication" manually on the SQL Server®, the installer does not have permissions to configure this during the install of the application server.

Go to Component Services, Expand down to "My Computer"

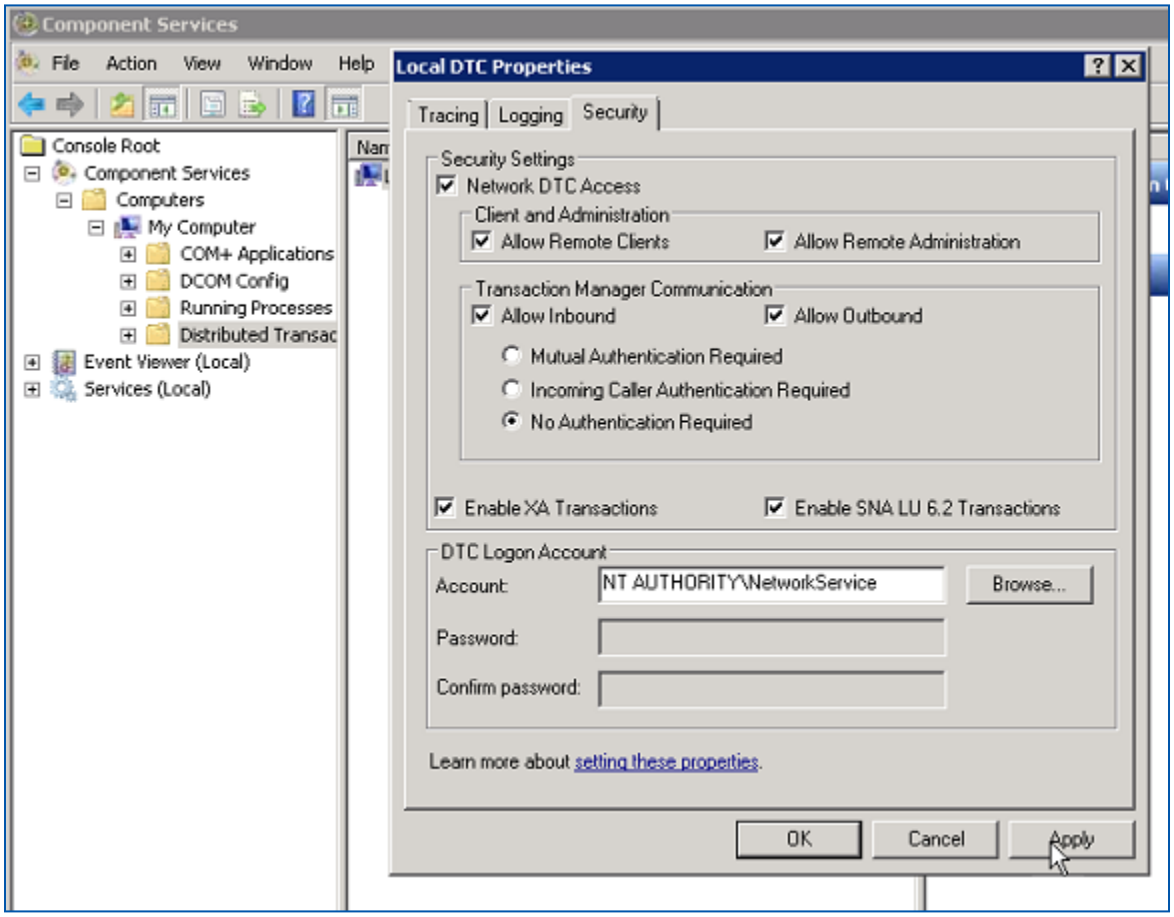
Right click on my computer and go to properties

Switch to the Default properties tab.



Ensure "Enable Distributed COM" is enabled as shown above.

Expand my computer and right click on "Local DTC" and go to properties.

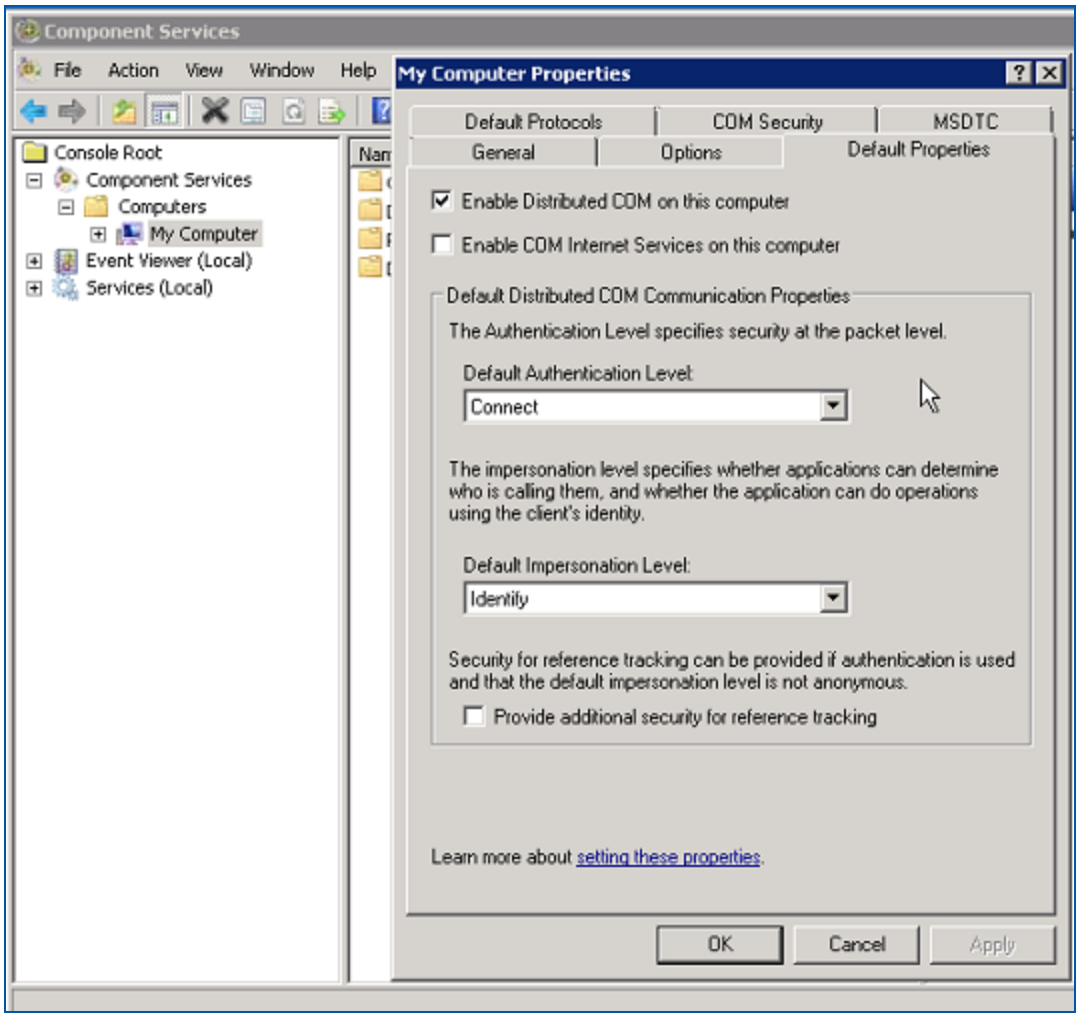


Configure as shown in the screenshot above.

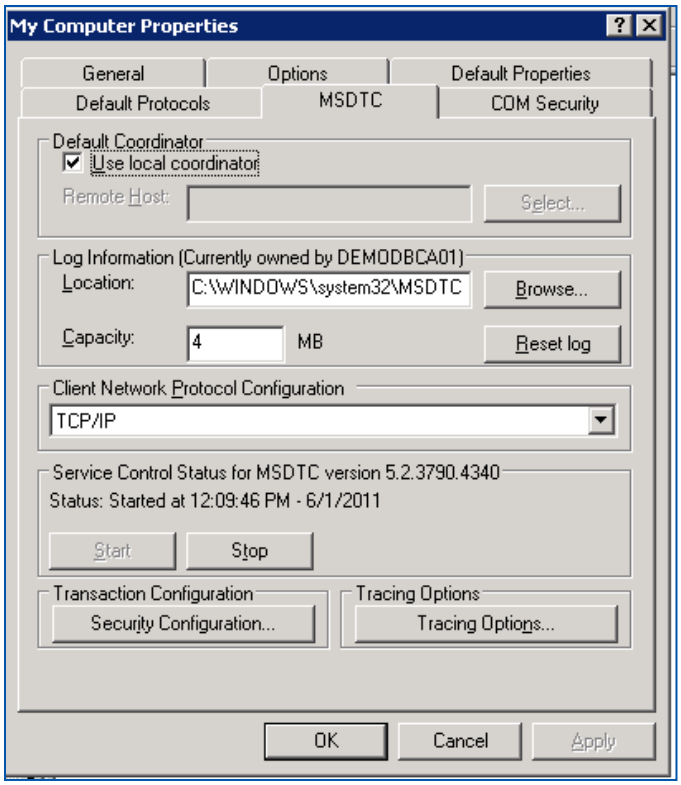
7.2 Windows® Server 2003 MSDTC Setup

MSDTC needs to be configured for "no authentication" manually on the SQL Server®, the installer does not have permissions to configure this during the install of the application server

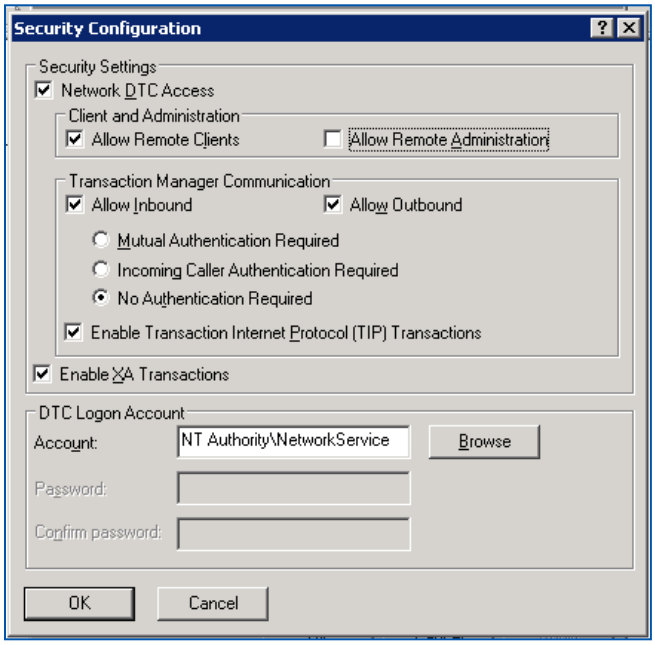
- Go to Component Services, Expand down to "My Computer"
- Right click on my computer and go to properties
- Switch to the Default properties tab.



- Ensure "Enable Distributed COM" is enabled as shown above.
- Switch to “MSDTC” tab and click “Security Configuration”

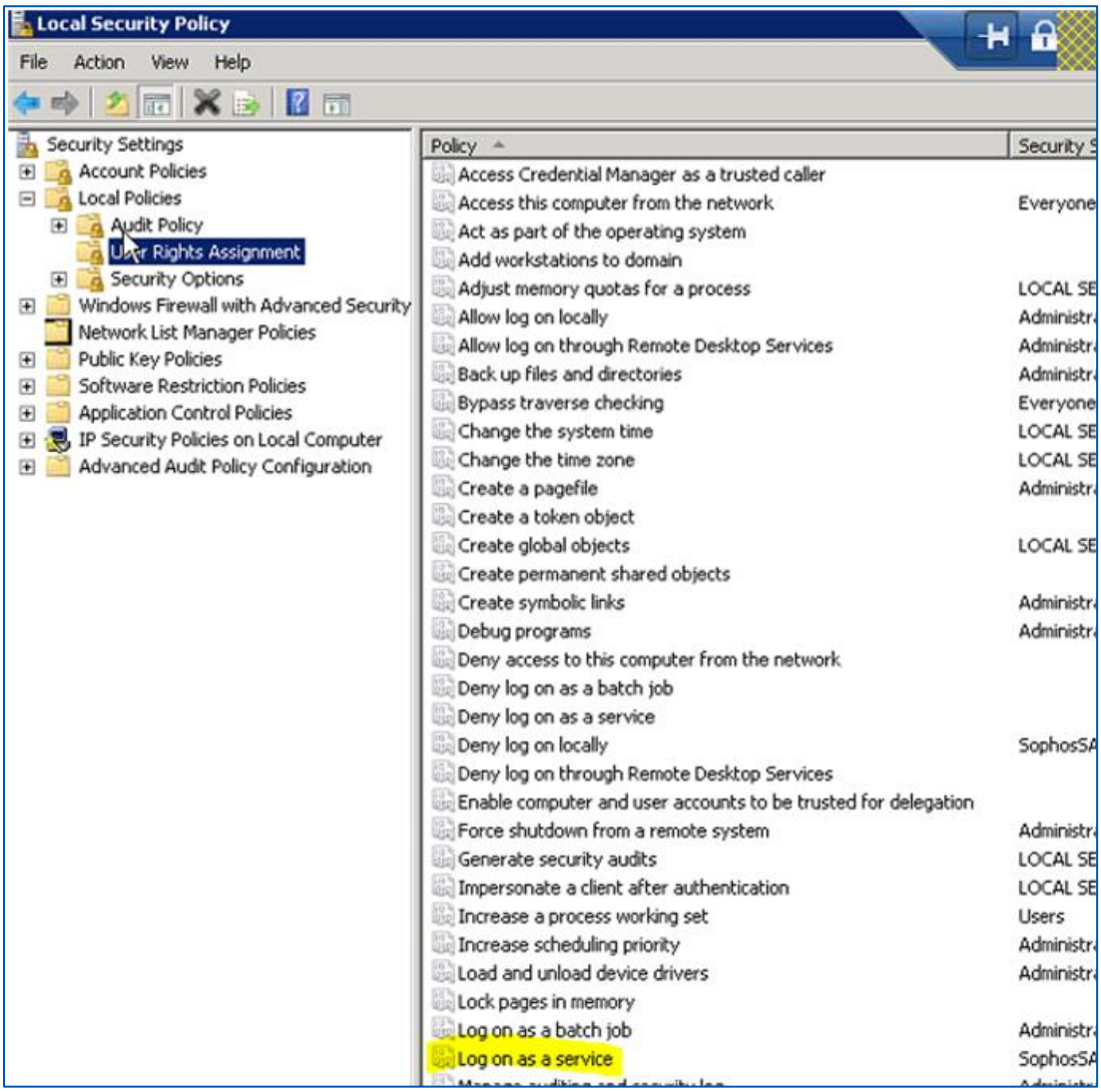


- Configure the security settings as follows:

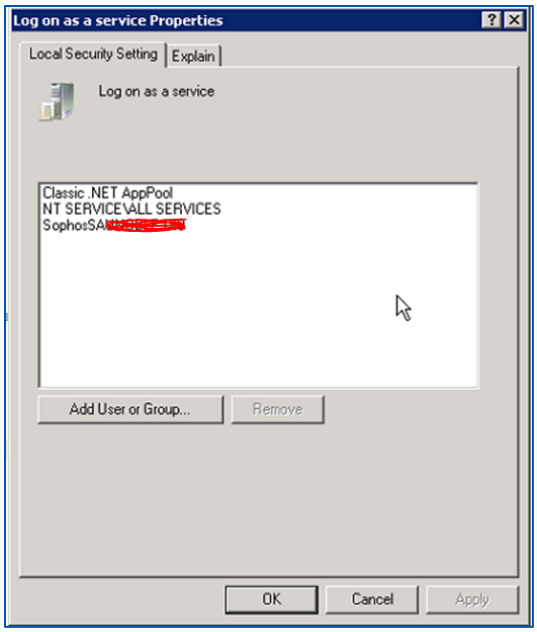


7.3 Configure Logon as a Service Right

- Configure service account with logon as a service right
- Open Local security Policy mmc (Administrative Tools)



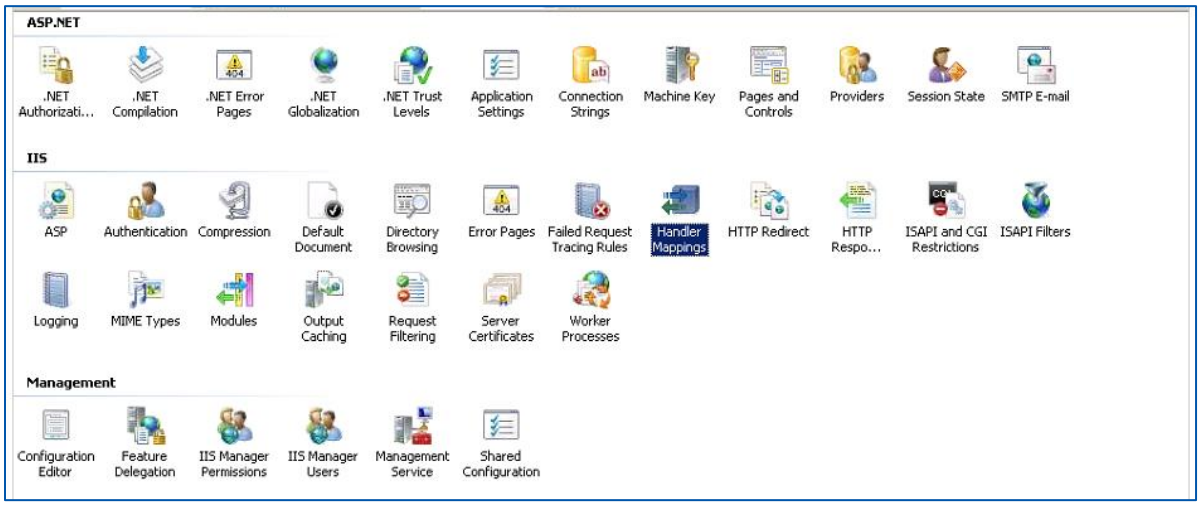
- Double click logon as a service
- Then click Add User or Group



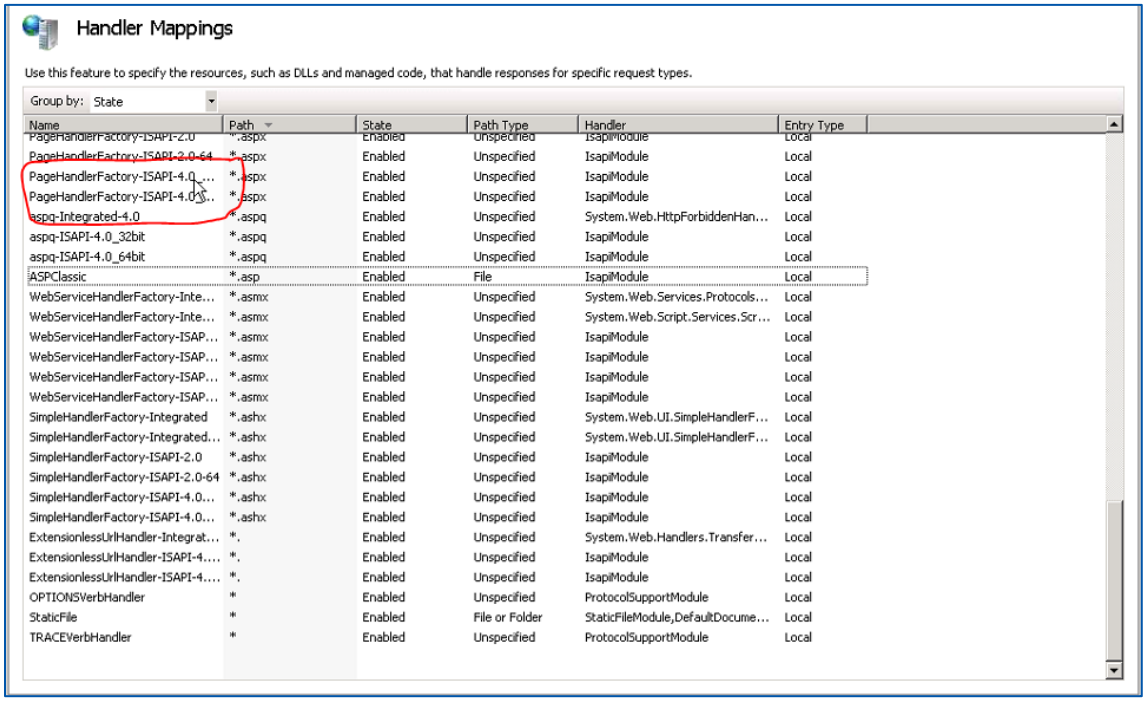
- Specify the service account and click OK.
- Click OK/Apply when finished.

7.4 Verifying .NET version is installed in IIS

- Verify ASP.NET 4 is installed
- In IIS console go to IIS>Handler Mappings



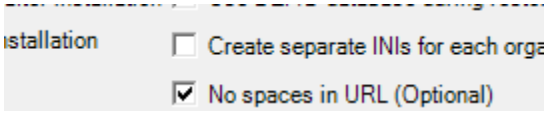
- Search for *.aspx, verify PageHandlerFactory-ISAPI-### where ### matches the .net framework version



7.5 F5 Configuration Guide

7.5.1 Configuration "Name" Placeholders

- [Partition]
  - Recommended as an identifier to organize the entities, e.g. "LNOSFW"
- [APPUI]
  - In a Descartes Route Planner standalone environment there are two possible "apps"
    - LNOS%20FW%20UI (or LNOSFWUI if no spaces installer options is used)



    - This can be used on the UI or BIF/App/Interface servers
  - STAD
    - This is only used on the BIF/App/Interface servers
- [Company/Env]
  - This is an identifier either for the company (in a multi-company environment) and/or environment (prod, test, etc)

7.5.2 Pre-setup

- HTTP Profile
  - Name: http-wan-optimized-compression-xfwd
  - Parent Profile: http-wan-optimized-compression
  - Insert X-Forwarded-For (Click Custom): Enabled
- SSL setup
  - Upload pfx certificate to SSL certificates - need admin account
  - NOTE: this is only required if using HTTPS.
- iRule Setup
  - Create iRule: https_redirect_Preserve_URI
  - Code:

```
when HTTP_REQUEST {
HTTP::respond 301 Location "https://[getfield [HTTP::host] : 1][HTTP::uri]"
}
```

7.5.3 Monitor setup

- **Place Holders:**
  - [Partition] – recommended as an identifier to organize the entities, e.g. "LNOSFW"
  - [APPUI] – in a Descartes Route Planner standalone environment there are two possible "apps"

        - LNOS%20FW%20UI (or LNOSFWUI if no spaces installer options is used): This can be used on the UI or BIF servers
        - STAD: This is only used on the BIF servers
    - [Company/Env] can is an identifier either for the company (in a multi-company environment) or environment (prod, test, etc)
- **Create a basic HTTP Monitor**
    - Name: LNOS_**[PARTITION]**_Monitor_HTTP
    - Type: HTTP
    - Configuration: advanced
    - Interval: 30 seconds
    - Timeout: 46 seconds
        - The timeout is configured to the interval + 16 seconds allowing at least one failure to handle packet drops.
    - Send String: GET /\r\n
- **Create an HTTP App "core" Monitor for each app (e.g. FW, STAD, RPS, TM, DRB)**
    - **Name**: LNOS_**[PARTITION]**_Monitor_HTTP_**[App]**_Core
    - **Type**: HTTP
    - **Configuration**: advanced
    - **Interval**: 60 seconds
    - **Timeout**: 76 seconds
        - The timeout is configured to the interval + 16 seconds allowing at least one failure to handle packet drops.
    - **Send String**: GET /**[APPUI]**/Core/CtyXmlInterface/DCFListener.asp\r\n
    - **Receive String**: <Root>DCF HTTP Listener</Root>
- **Create HTTP App "Login Page" Monitor for each app (e.g. FW, STAD,RPS, TM, DRB)**
    - **Name**: LNOS_**[PARTITION]**_Monitor_HTTP_**[App]**_LoginPage
    - **Type**: HTTP
    - **Configuration**: advanced
    - **Interval**: 60 seconds
    - **Timeout**: 16 seconds
    - **Send String**: GET /**[APPUI]**/Default.asp HTTP/1.0\r\nUser-Agent: Mozilla/4.0 (compatible; MSIE 6.0; WIndows NT5.1; SV1; .NET CLR 1.1.4322; .NET CLR 2.0.50727)\r\n\r\n
    - **Receive String**: INPUT TYPE=\"text\" NAME=\"LoginName\"
- **HTTPS**
    - If using HTTPS, repeat the steps above choosing a TYPE of HTTP**S**, adjust the name of the monitor accordingly.

7.5.4 Node setup

- **Repeat for each node in cluster**
  - **Address**: IP for server
  - **Name**: hostname
  - **Health monitors**: Node specific
  - **Select node monitors from list**:
    - icmp

7.5.5 Pool setup

- **HTTP Pool:**
  - **Name**: LNOS_[Company/Env]_UI_HTTP
  - **Configuration**: Advanced
  - **Health Monitor** (choose each app in use by server type):
    - LNOS_[PARTITION]_Monitor_HTTPS_[App]Core
    - LNOS_[PARTITION]_Monitor_HTTPS_[App]LoginPage
  - Availability Requirement: All
  - Allow SNAT: yes
  - Allow NAT: yes
  - Load balancing Method: Round Robin
  - Members: choose nodes and port 80
    - Inherit monitors from pool
- **HTTPS Pool:**
  - Repeat HTTP pool setup using HTTPS monitors
  - **Members**: choose nodes and **port 443**
    - Inherit monitors from pool

7.5.6 Virtual Server Setup

- **HTTP VIP (UI Server, persistence required)**
  - Name: VIP_LNOS_[Company/Env]_UI_HTTP
  - Type: Host
  - Address: Cluster IP
  - Service Port: 80 (HTTP)
  - Configuration: advanced
  - Protocol Profile (Client): TCP-wan-optimized
  - Protocol Profile (Server): TCP-lan-optimized
  - VLAN and Tunnel Traffic: Enabled on…
    - [VLAN OF SERVERS]
  - HTTP Profile: http-wan-optimized-compression-xfwd
  - Clone Pool (Client): None
  - Clone Pool (Server): None
  - Last Hop Pool: None
  - Default Pool: LNOS_[Company/Env]_UI_HTTP
  - Default Persistence Profile: **cookie**
  - Fallback Persistence Profile: **Source_addr**
  - **Resources>Default Pool**
    - Choose the UI pool
- **HTTP VIP (Interface Server, persistence not required)**
  - Name: VIP_LNOS_[Company/Env]_Interface_HTTP
  - Type: Host
  - Address: Cluster IP
  - Service Port: 80 (HTTP)
  - Configuration: advanced
  - Protocol Profile (Client): TCP-wan-optimized
    - Customer face, using wan otherwise lan (e.g. ag bif is customer facing)
  - Protocol Profile (Server): TCP-lan-optimized
  - HTTP Profile: http-wan-optimized-compression-xfwd
  - VLAN and Tunnel Traffic: Enabled on…
    - [VLAN OF SERVERS]
  - Clone Pool (Client): LNOS_[Company/Env]_BIF_HTTP
  - Clone Pool (Server): LNOS_[Company/Env]_BIF_HTTP
  - Last Hop Pool: LNOS_[Company/Env]_BIF_HTTP
  - iRules: https_redirect_Preserve_URI
  - Default Pool: LNOS_[Company/Env]_BIF_HTTP
  - Default Persistence Profile: **None**
  - Fallback Persistence Profile: **None**

- **Save**
- **Resources>Default Pool**
  - Choose the BIF (Interface) pool

- **HTTPS VIP (UI Server, persistence required)**
  - Repeat HTTP UI steps with the following differences.
  - **Service Port**: **443**(HTTPS)
  - iRules: https_redirect_Preserve_URI
  - SSL Profile (Client): [ssl cert uploaded]_Client
  - SSL Profile (Server): [ssl cert uploaded]_Server
    - Only required if server has "require SSL" enabled in IIS, useful during migrations.
    - Not required otherwise and recommended to not to not do this long term as it increases workload on both BIG-IP and prevents offloading the SSL work from the server.
- **HTTPS VIP (BIF Server, persistence NOT required)**
  - Repeat HTTP BIF steps with the following differences.
  - **Service Port**: **443**(HTTPS)
  - SSL Profile (Client): [ssl cert uploaded]_Client
  - SSL Profile (Server): [ssl cert uploaded]_Server
    - Only required if server has "require SSL" enabled in IIS, useful during migrations.
    - Not required otherwise and recommended to not to not do this long term as it increases workload on both BIG-IP and prevents offloading the SSL work from the server.

7.5.7 Security Recommendations

The following articles provide recommendations on closing known vulnerabilities related to the F5 configuration

- SSL
  - SSLv3 vulnerability (Poodle) CVE-2014-3566
    - https://support.f5.com/kb/en-us/solutions/public/15000/700/sol15702.html?sr=43924017
  - TLS1.x padding vulnerability CVE-2014-8730
    - https://support.f5.com/kb/en-us/solutions/public/15000/800/sol15882.html?sr=43924061

7.5.8 Troubleshooting recommendations

- Invalid Node Flapping
  - Symptom

- If it is identified that the monitors appear to be "flapping" (up/down) when there is no problems with the application, and it appears to be affecting all monitors simultaneously on a routine interval (e.g. five minutes).

- Root Cause
  - If it is identified that the monitors appear to be "flapping" (up/down) when there is no problems with the application, and it appears to be affecting all monitors simultaneously on a routine interval (e.g. five minutes) this can occur if the failover node has the same self-ip as the primary node and when the switch's ARP cache expires it will re-negotiate which MAC owns the IP causing a drop in packets until resolved.

7.5.9 Configuration Screenshots

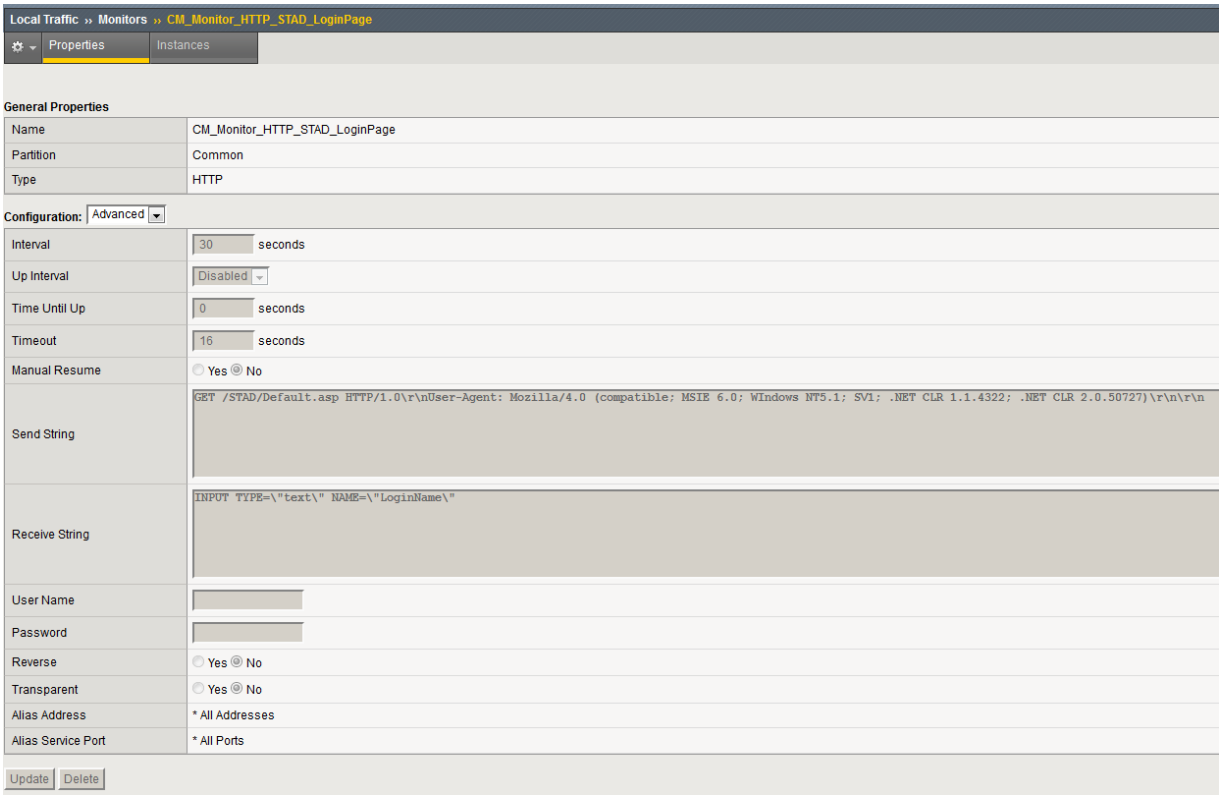
iRule:

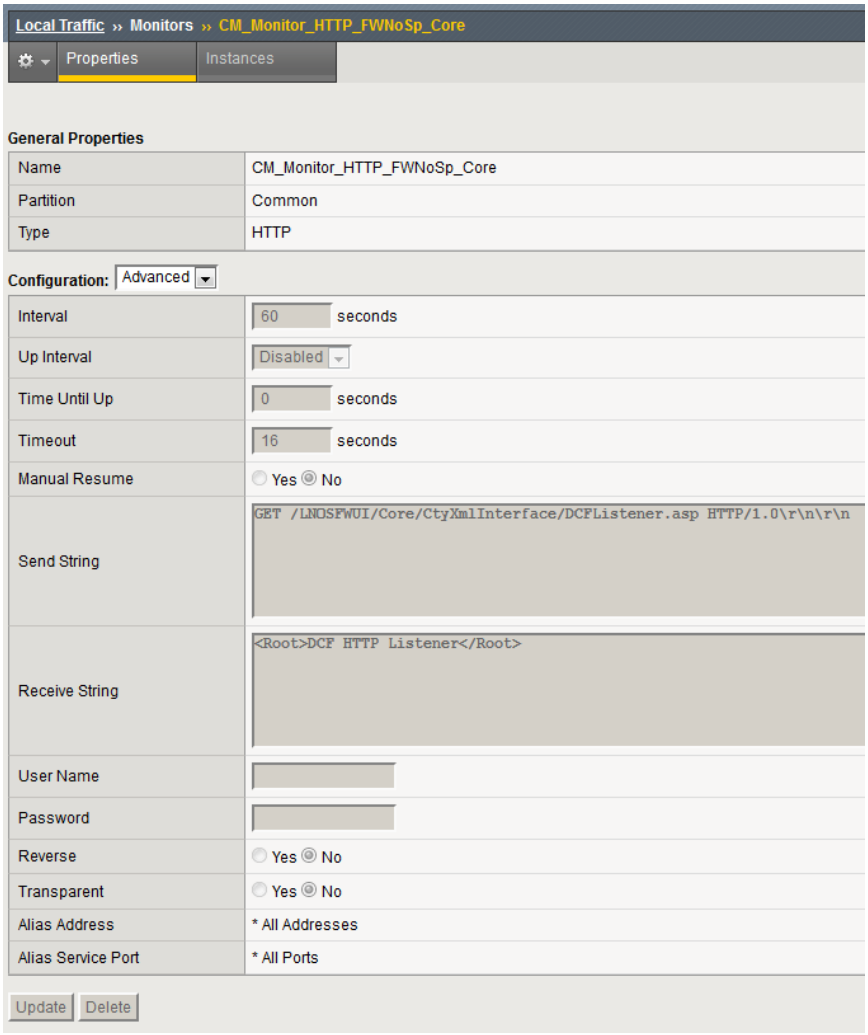
Properties

Name	http_redirect
Partition	Common

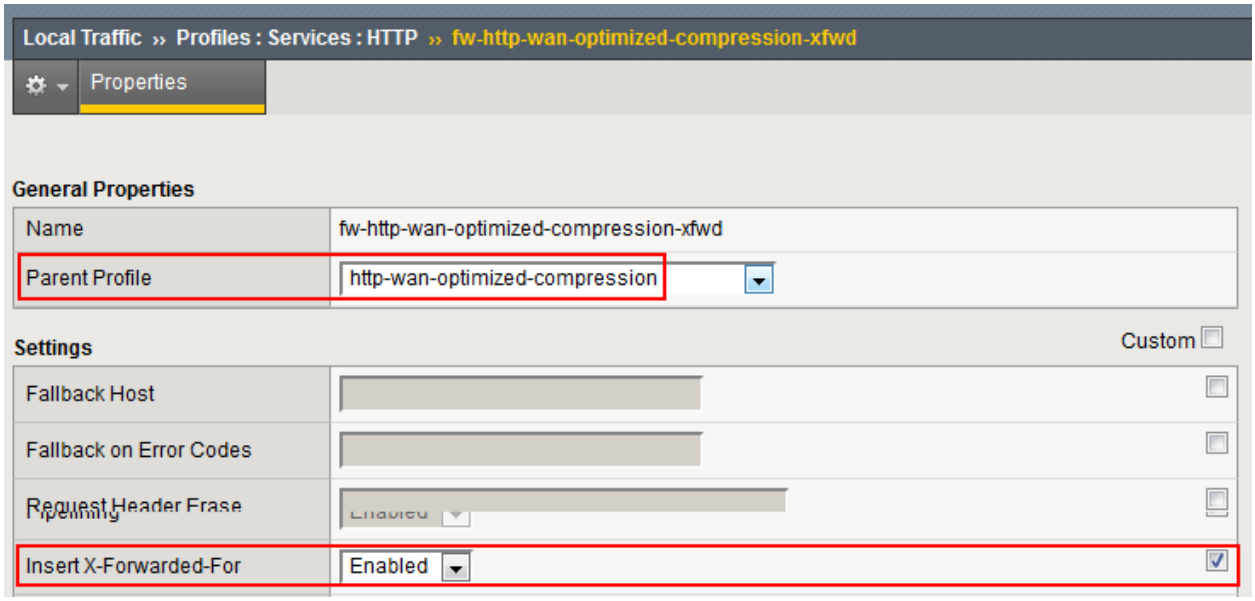
```
when HTTP_REQUEST {
     HTTP::respond 301 Location "https://[getfield [HTTP::host] : 1][HTTP::uri]"
}
```

Monitors:

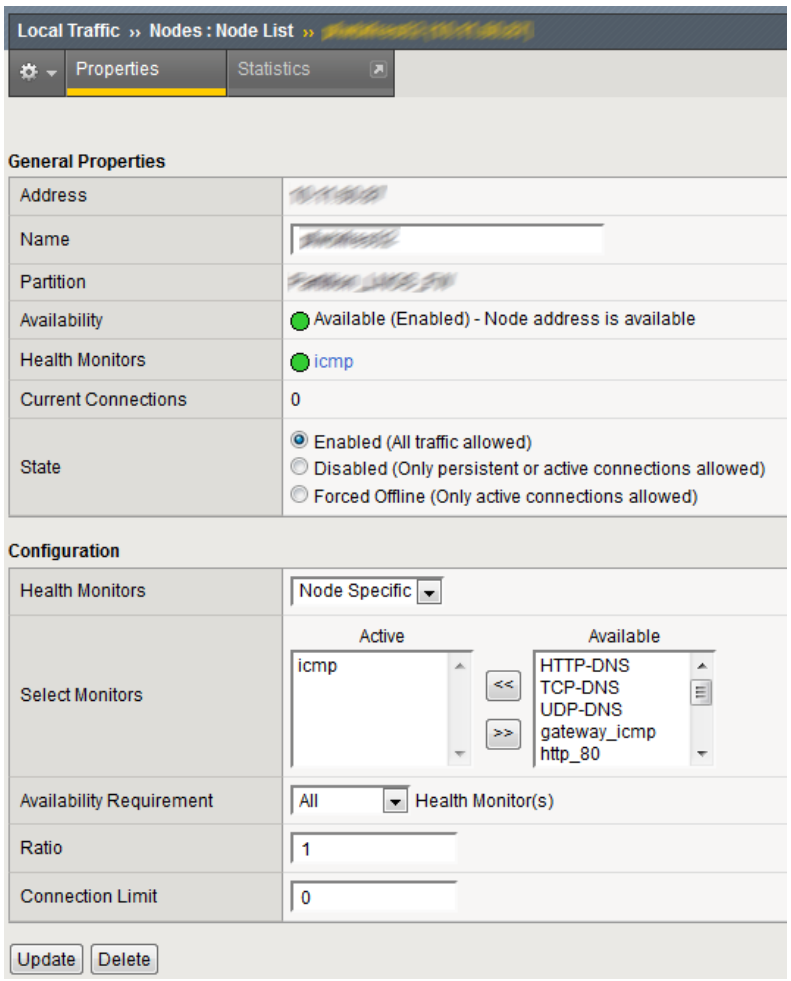

Local Traffic ›› Monitors ›› CM_Monitor_HTTP_STAD_LoginPage
Properties
Instances
General Properties
Name
CM_Monitor_HTTP_STAD_LoginPage
Partition
Common
Type
HTTP
Configuration: Advanced
Interval
30
seconds
Up Interval
Disabled
Time Until Up
0
seconds
Timeout
16
seconds
Manual Resume
Yes No
Send String
GET /STAD/Default.asp HTTP/1.0\r\nUser-Agent: Mozilla/4.0 (compatible; MSIE 6.0; WIndows NT5.1; SV1; .NET CLR 1.1.4322; .NET CLR 2.0.50727)\r\n\r\n
Receive String
INPUT TYPE=\"text\" NAME=\"LoginName\"
User Name
Password
Reverse
Yes No
Transparent
Yes No
Alias Address
* All Addresses
Alias Service Port
* All Ports
Update
Delete


Local Traffic » Monitors » CM_Monitor_HTTP_FWNoSp_Core
Properties
Instances
General Properties
Name
CM_Monitor_HTTP_FWNoSp_Core
Partition
Common
Type
HTTP
Configuration: Advanced
Interval
60
seconds
Up Interval
Disabled
Time Until Up
0
seconds
Timeout
16
seconds
Manual Resume
Yes
No
Send String
GET /LNOSFWUI/Core/CtyXmlInterface/DCFListener.asp HTTP/1.0\r\n\r\n
Receive String
<Root>DCF HTTP Listener</Root>
User Name
Password
Reverse
Yes
No
Transparent
Yes
No
Alias Address
* All Addresses
Alias Service Port
* All Ports
Update
Delete

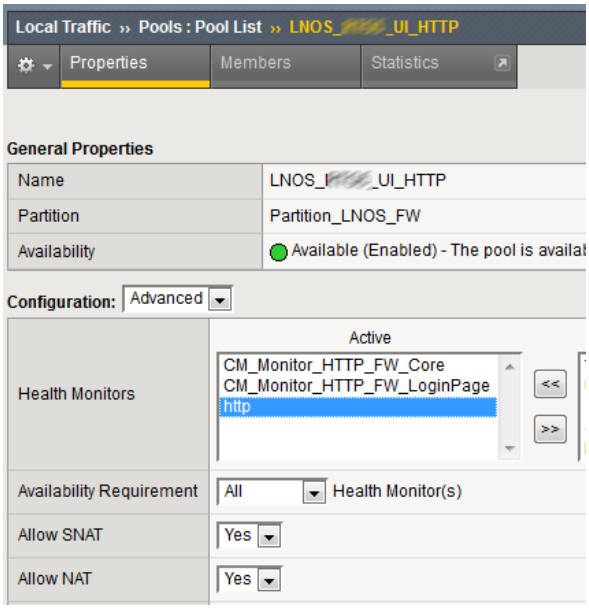
HTTP Profile:

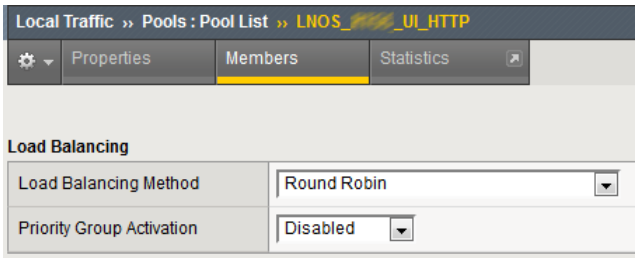


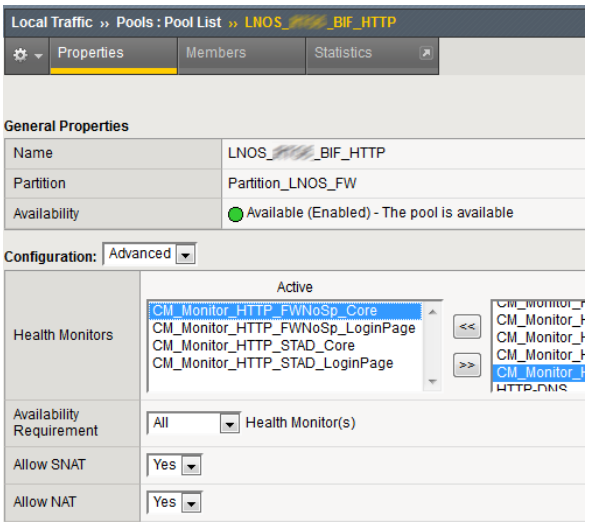
Nodes:

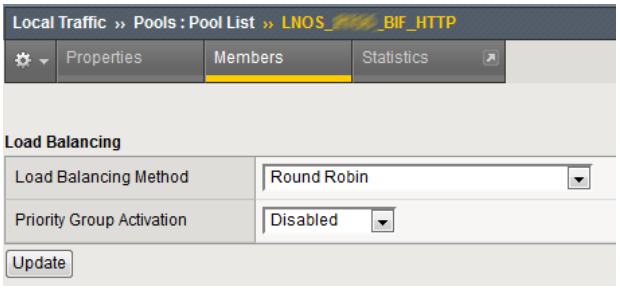


Pools:

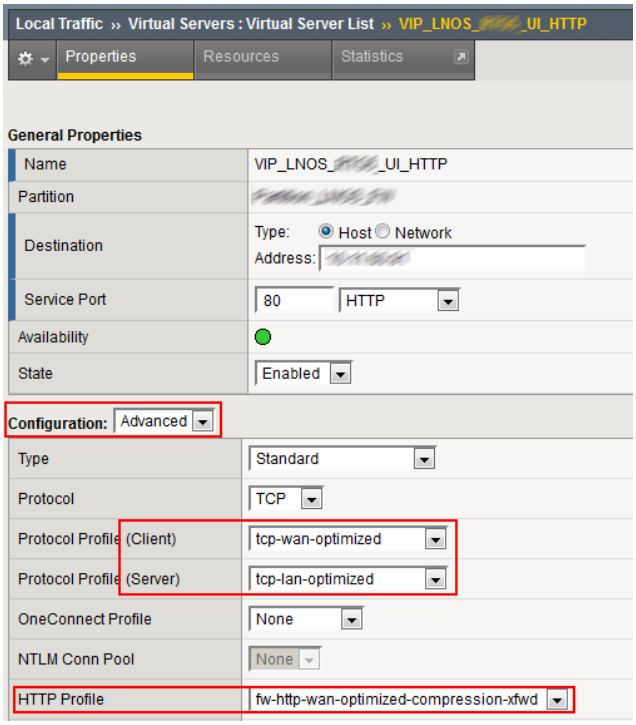

Local Traffic ›› Pools : Pool List ›› LNOS_[redacted]_UI_HTTP
Properties
Members
Statistics
General Properties
Name
LNOS_[redacted]_UI_HTTP
Partition
Partition_LNOS_FW
Availability
Available (Enabled) - The pool is availat
Configuration: Advanced
Health Monitors
Active
CM_Monitor_HTTP_FW_Core
CM_Monitor_HTTP_FW_LoginPage
http
<<
>>
Availability Requirement
All
Health Monitor(s)
Allow SNAT
Yes
Allow NAT
Yes

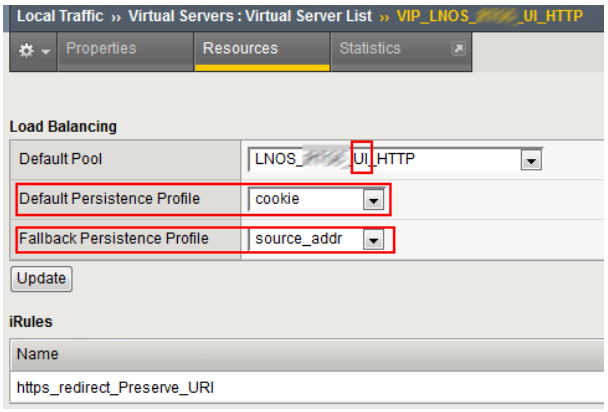

Local Traffic ›› Pools : Pool List ›› LNOS_[redacted]_UI_HTTP
Properties
Members
Statistics
Load Balancing
Load Balancing Method
Round Robin
Priority Group Activation
Disabled

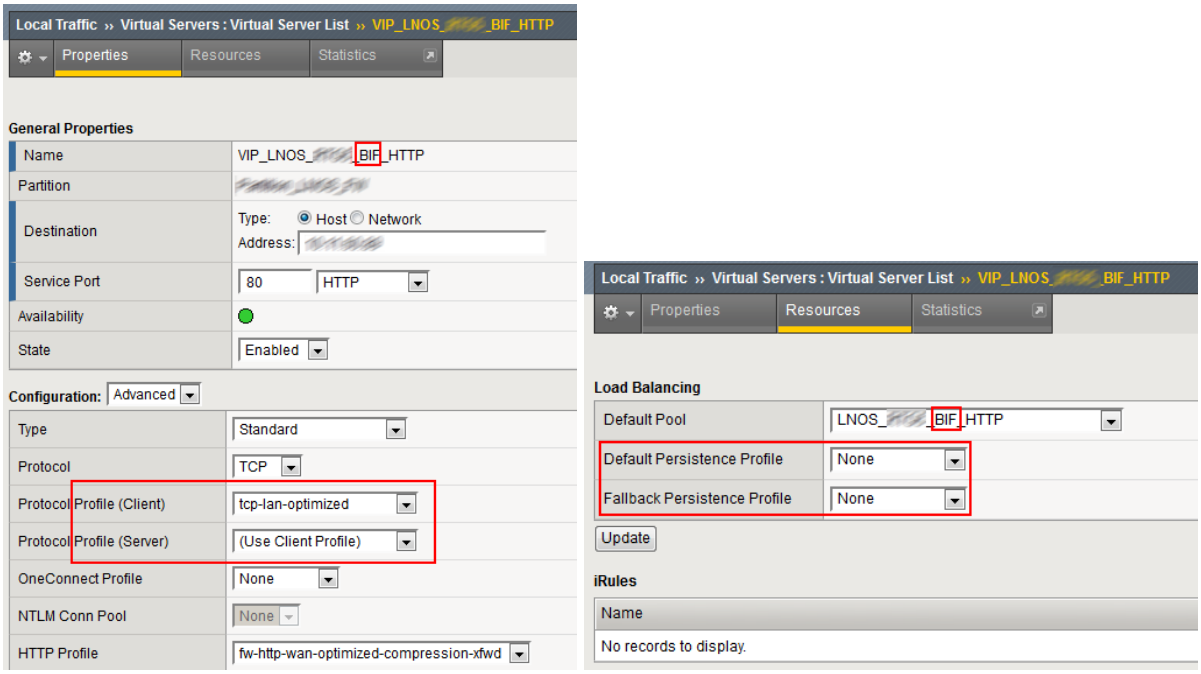

Local Traffic ›› Pools : Pool List ›› LNOS_[redacted]_BIF_HTTP
Properties
Members
Statistics
General Properties
Name
LNOS_[redacted]_BIF_HTTP
Partition
Partition_LNOS_FW
Availability
Available (Enabled) - The pool is available
Configuration: Advanced
Health Monitors
Active
CM_Monitor_HTTP_FWNoSp_Core
CM_Monitor_HTTP_FWNoSp_LoginPage
CM_Monitor_HTTP_STAD_Core
CM_Monitor_HTTP_STAD_LoginPage
<<
>>
Availability Requirement
All
Health Monitor(s)
Allow SNAT
Yes
Allow NAT
Yes


Local Traffic ›› Pools : Pool List ›› LNOS_[redacted]_BIF_HTTP
Properties
Members
Statistics
Load Balancing
Load Balancing Method
Round Robin
Priority Group Activation
Disabled
Update

Virtual Server:







7.6 Microsoft® NLB Configuration (Windows® 2003)

7.6.1 Responsibilities

7.6.1.1 Customers' Responsibilities

- Ensure each server in the cluster has individual monitoring.

  WARNING: Network load balancing is not application aware it provides load balancing at the port level (Layer 4). A node is considered to be "down" and non-functional if it fails to respond to five (by default) consecutive heartbeat tests (occur at the MAC address level).

- Any network configurations changes required, if deemed necessary during testing.
- Determine cluster name and IP address.
- **Ensure servers have two Network Interface Cards per server if deemed to be necessary.**

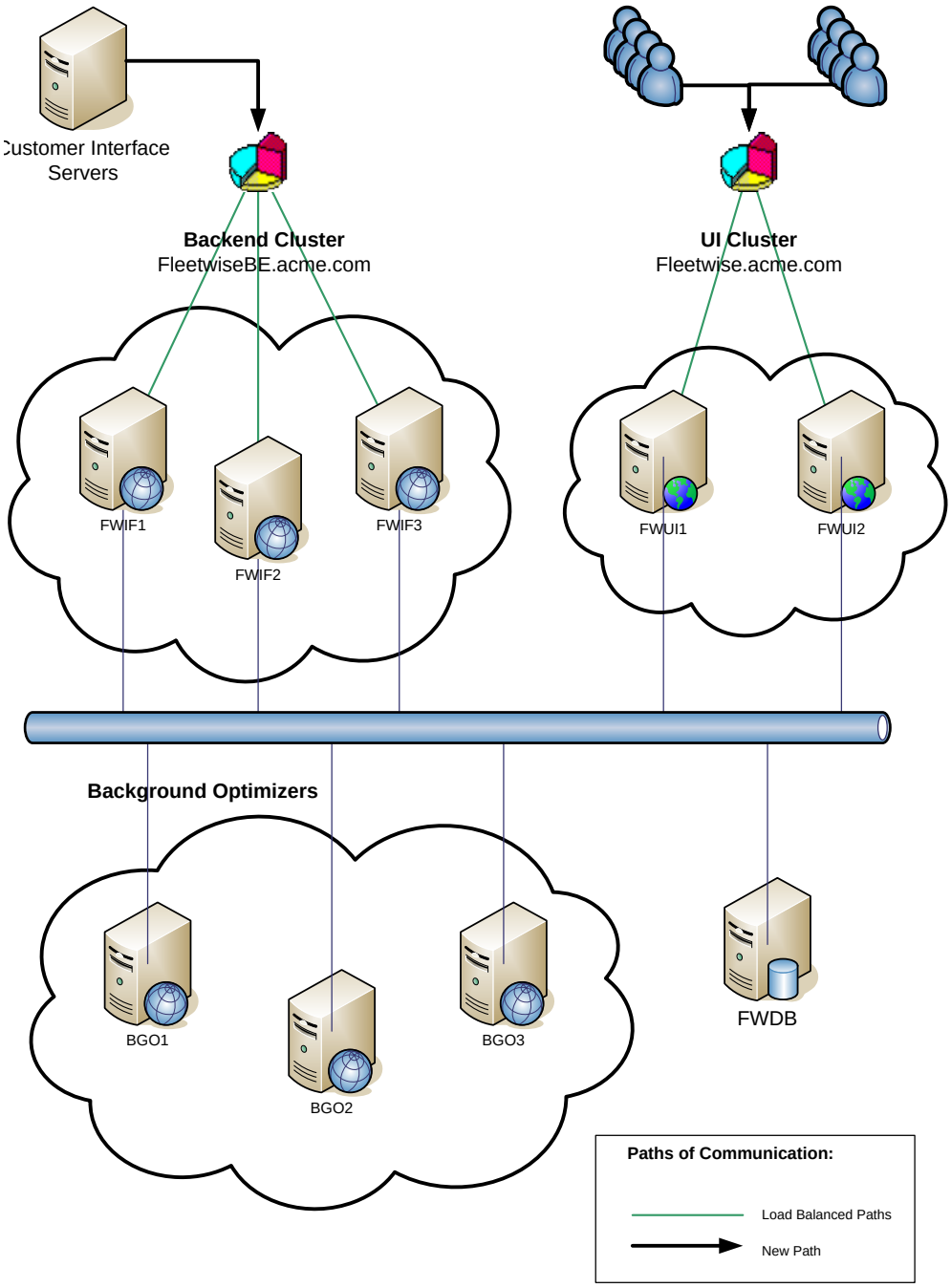
  Note— The Microsoft® Best Practices recommends two Network Interface Cards per server, one for cluster traffic and one for node management.

7.6.1.2 Descartes' Responsibilities

- Deploy Microsoft® NLB cluster for backend servers (using "No" affinity)

- Deploy Microsoft® NLB cluster for UI servers (using "Single" affinity)
- Configure all backend servers so they can handle NLB.
- Configure SessionServer database for UI servers.
- Train Customer employees in the use of Microsoft® NLB.

7.6.1.3 Clustering Architecture



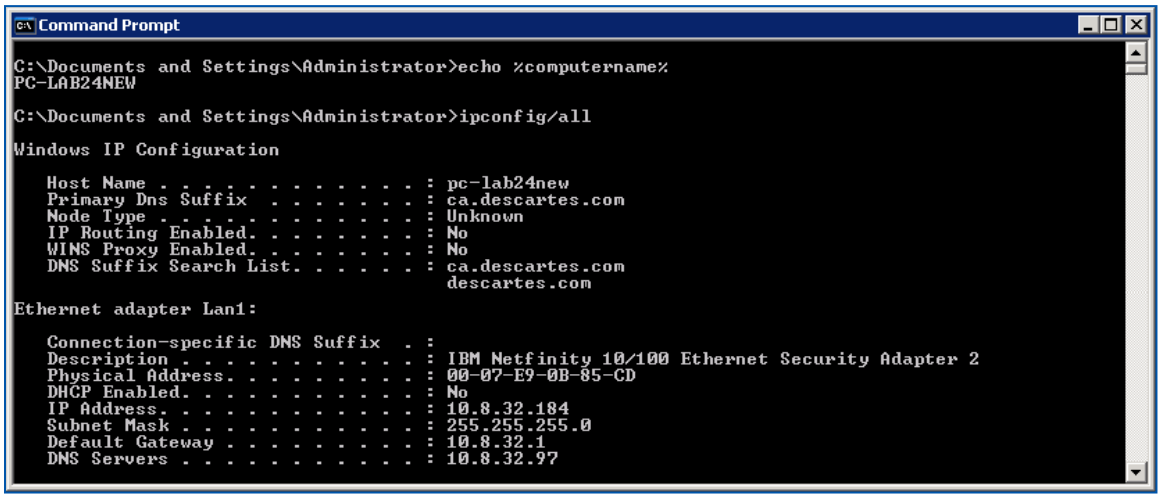
7.6.2 Setup and Configuration of NLB Clusters

7.6.2.1 Preparation tasks

- For each server node to be added to the cluster:
  - Confirm and/or configure static IP's.

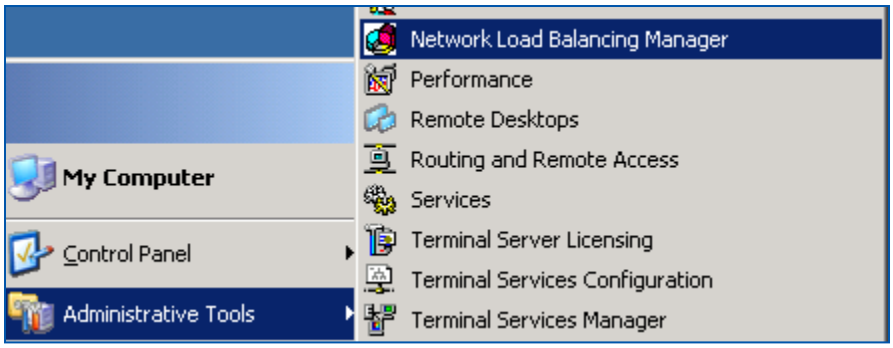
  ➲ **Note—** Only Static IP's are allowed by NLB.

  - Record the IP Address.
  - Record the MAC Address
  - Record the subnet mask.
  - Record the DNS Host name.
- This can be done by opening a command prompt and executing "ipconfig /all".



7.6.2.2 Define the Cluster

- The first step in deploying an NLB cluster is to define the new cluster with a single node.
- Connect to the first node to be added to the cluster.
- Open the start menu and navigate to Administrative Components>Network Load Balancing Manager.



- When cluster manager finishes loading, right click on the "Network Load Balancing Clusters" and choose "New Cluster" as shown in Figure 1.

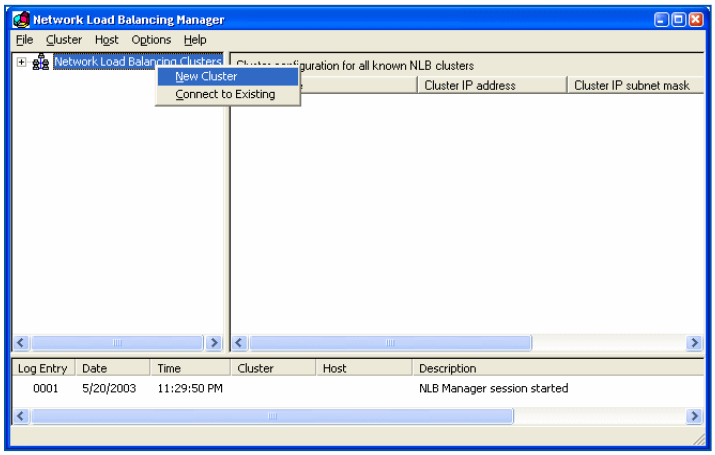


Figure 1 – Creating a new cluster.

- Next the basic cluster configuration will need to be defined consisting of the following components:
  - IP Address – This is the virtual IP address used to access the cluster.
  - Subnet Mask – This must be the same as all nodes in the cluster.
  - Full Internet Name – This is the Fully Qualified name as defined in DNS.

  ➲ **Note—** This may need to be added to DNS manually.

  - Cluster Operation Mode – This must be set to multicast in a switch-based environment.
  - Network Address – This is the virtual MAC address for the cluster. Record this address in case manual configuration changes are required on the switch and/or router.
  - IGMP Multicast – Ensure this is turned off.
  - Allow Remote Control – Ensure this is unchecked as per Microsoft® Best Practices.

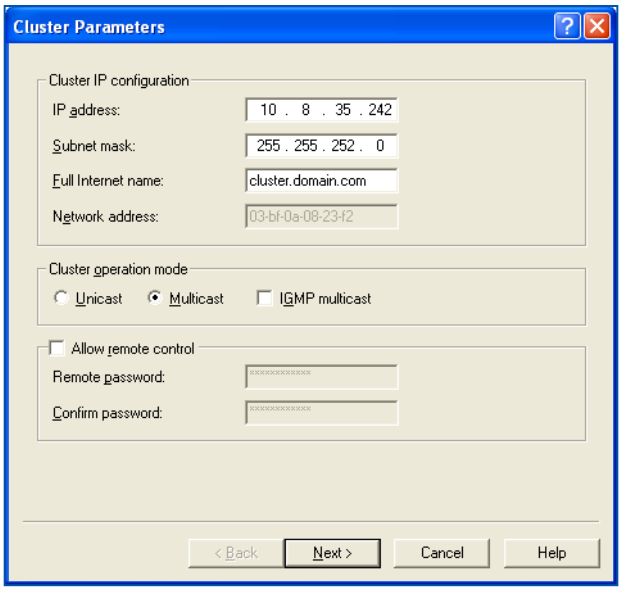


Figure 2 – Typical Cluster Configuration

- Click Next to complete basic cluster configuration.
- Additional virtual cluster IP addresses can be configured at this time but that process will not be covered in this section (see Figure 3).

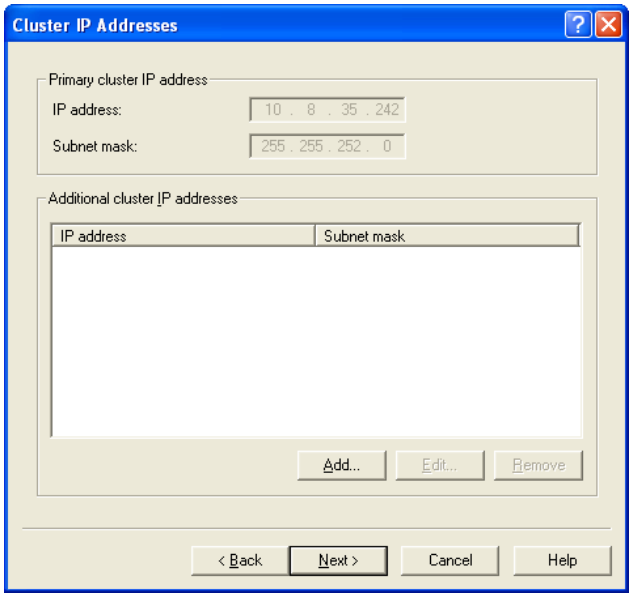


Figure 3 – Configuring additional Cluster IP addresses

- Click Next to skip defining additional addresses.

- Next the port rules for the cluster need to be defined. By default NLB defines a rule for ports 0 to 65535 (See Figure 4). This rule will be removed and new rules will be defined.

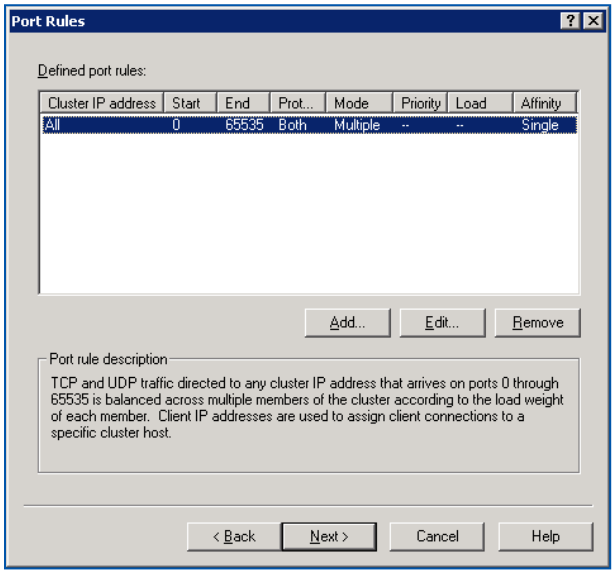


Figure 4 – Default port configuration rules

- To do this click on the rule and press the "Remove" button.
- Configure new port rules. Port rules determine which TCP/IP port is handled and how.
- To add a new port rule click on the "Add" button which brings up the dialog shown in Figure 5.

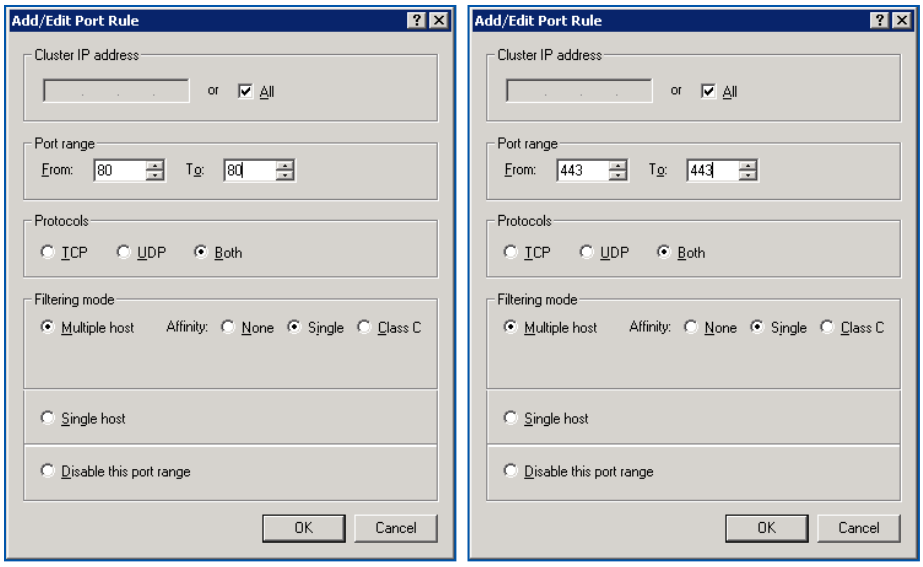


Figure 5 – Adding new Port Rules (HTTP/HTTPS).

- The first rule to define is for HTTP using the following settings:
  - Port Range – From 80 to 80
  - Protocols – Both
  - Filtering Mode – NONE, this ensures that backend calls will be distributed evenly across all nodes in the cluster this is deemed to be safe for **synchronous** backend calls.
- Click OK to complete this port definition.
- The first rule to define is for HTTPS using the following settings:
  - Port Range – From 443 to 443
  - Protocols – Both
  - Filtering Mode – NONE, this ensures that backend calls will be distributed evenly across all nodes in the cluster this is deemed to be safe for **synchronous** backend calls.
- Click OK to complete this port definition.
- The port rules should look like those shown in Figure 6.

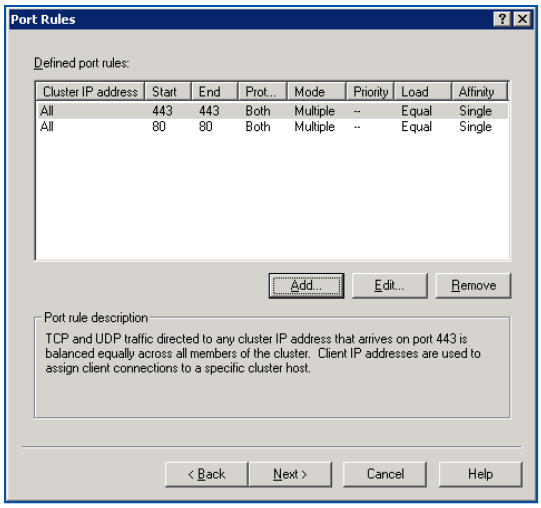


Figure 6 – Configuring the Port Rules.

- Click Next to complete the port configuration.

7.6.2.3 First Node

- Connect the first node to the cluster. Enter the host name or IP address (local) of the first node to be added to the cluster.
- Click on Connect
- Choose the Interface that matches the IP address you recorded earlier for the node. (See figure 7)

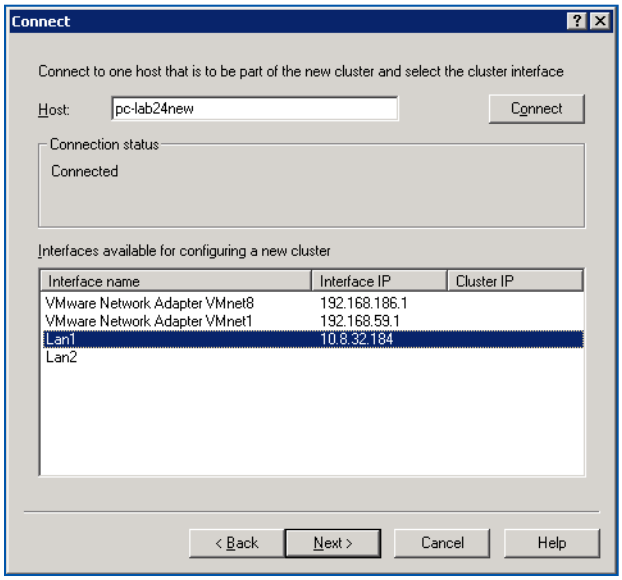


Figure 7 – Connecting to the cluster and assigning an interface

- Click Next to complete the Interface selection.
- Define the Host parameters.
- Use the following settings:
  - Priority – 1 This is the first node in the cluster
  - IP Address – do not change this
  - Subnet Mask – do not change this
  - Default State – Started
  - Retain suspended state after the computer restarts - check this.

  WARNING— If the server is put into a suspended state the only way to remove this suspended state is to manually resume the server. This does ensure that a server that has failed does not rejoin itself to the cluster.
- The values configured should look like those in Figure 8.

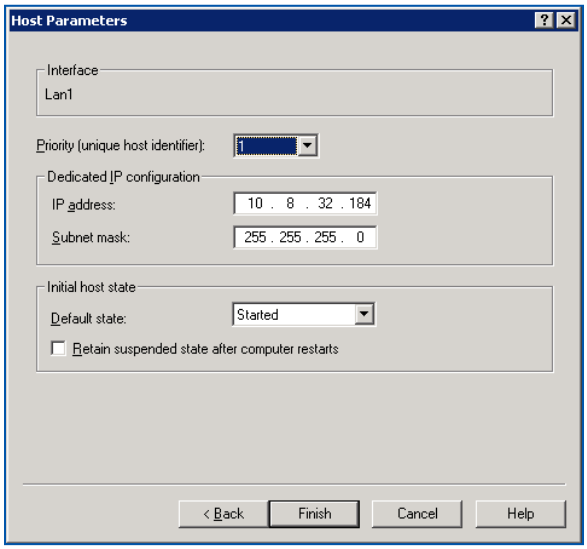


Figure 8 – Node 1 Host parameters.

- Click Finish.

  WARNING— This will cause slight network outage while the server reconfigures itself into the cluster.

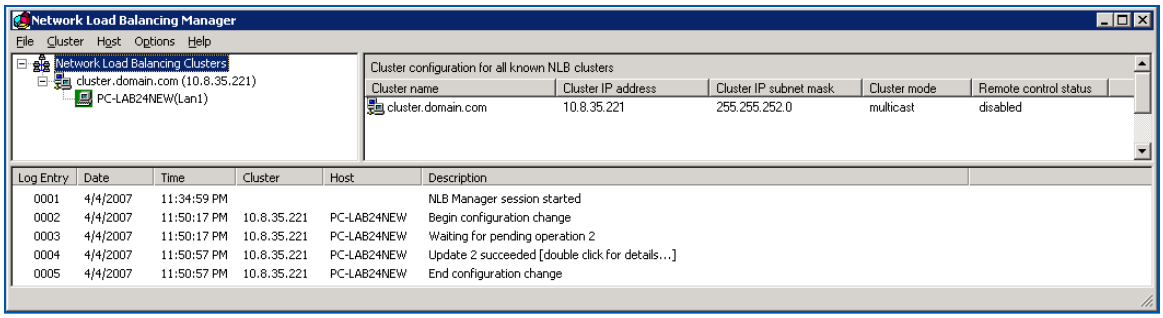
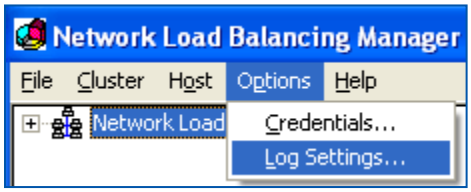


Figure 9 – Single node cluster configuration.

7.6.2.4 Enabling Logging

- It is important to enable logging to help troubleshoot issues during convergence and adding nodes to the cluster.
- To do this, click on the Options menu, then "Log Settings…"



- Check "Enable Logging"
- Type the file path as follows: C:\Windows\System32\LogFiles\NLB_log.TXT

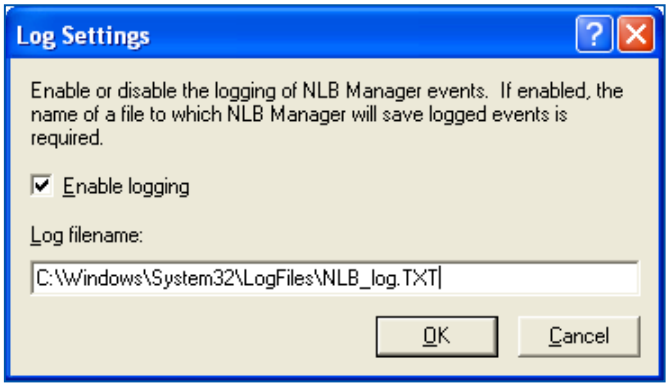


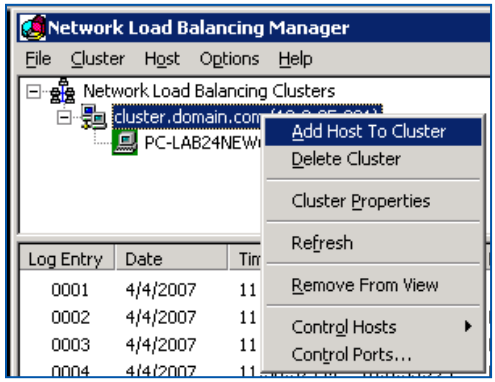
Figure 10 – NLB Log Settings

- Click OK to complete log configuration.

7.6.2.5 Adding additional nodes to the cluster

- If not open already, open the Network Load Balancing Manager under the Administrative tools.

- Right click on the Network Load Balancing Cluster and choose "Add Host to Cluster".



- Specify the Host Name/IP address of the second Node to be added.
- Follow the steps laid out in section 1.6 however the priority of each node needs to be unique (e.g. priority 2 for node 2, priority 3 for node 3, etc.)

  WARNING— This will cause a slight network outage while each server reconfigures itself into the cluster.

- If the following error (see Figure 11) is displayed (with a yellow exclamation on the second host). This is typically caused by the existing node being unable to communicate with the new node while it is reconfiguring the network card. Wait a couple of minutes and click the "Refresh" button, it should now show both as converged (all nodes green).

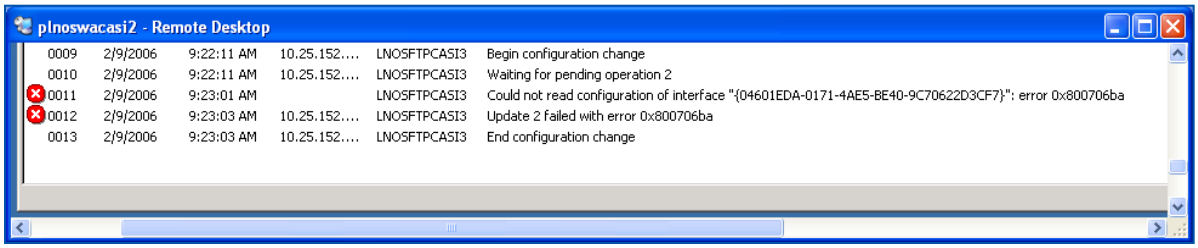


Figure 11 – Cluster error during add.

7.6.2.6 Enable multicast support

- Depending on the networking hardware used some configuration changes may be required on the switches and or routers.
- Not all switches and routers will dynamically configure the following settings.
- Based on the hardware at Customer sites the following commands most likely will need to be executed by Customer network team
- On the switch:
  - The following command may need to be executed to manually configure the multicast MAC address on the switch for each port on the server. From the

research completed the Cisco 2970 switch has difficulties registering this dynamically.
    - on a 2970 Cisco switch: **mac-address-table static** 03bf.ac10.321d eth0/5
- On the router:
    - The following command may need to be executed manually to configure the multicast MAC address ARP entry. This allows the router to assign the multicast MAC address as the destination before passing the packet to the switch for delivery.
    - on a Cisco router: **arp** 172.16.2.29 03bf.ac10.321d **ARPA**

    WARNING— Without the proper configuration, multicast traffic will effectively turn a switch into a hub as it will be treated as broadcast traffic. This causes network congestion and poor performance for all servers in the same subnet.
- Confirm this by connecting to both the switch and router and confirm the multicast MAC address registered correctly on both.
- Reconfirm this after each node is added to the cluster.

7.6.2.7 Testing the NLB Configurations

- Terminal service to each node in the cluster and perform the following:
    - Go to the properties of the network card selected during setup for each Node and verify that the Network Load Balancing is checked.

    Note— On a multi-homed Server, ensure you choose the correct interface.
    - Open a command prompt on each Node, and type IPCONFIG.
    - Make sure that both Virtual IP address and the Original IP address for each node are bound to the same interface.
    - From a command prompt, ping each node in the cluster and the cluster IP testing for connectivity.
    - Terminal service to another server in the same network (IP/Subnet set) and use ping to test each node.
    - From within the same network as the cluster ping the cluster IP and each node in the cluster.
    - From outside the NLB cluster's network ping the cluster IP and each node in the cluster.

7.6.2.8 Additional standard port rules

- If an FTP configuration needs to be deployed the following rules should be used.
    - IP: All, port 20-21, Protocol: Both, Mode: Multiple, Affinity: Single
    - IP: All, port 57000-57999, Protocol: Both, Mode: Multiple, Affinity: Single

7.7 Database Blocking Process SQL

```
--add this to dbastats DB
use dbastats

-- STEP 1: Create the history table
if exists (select * from dbo.sysobjects where id = object_id(N'[Lock_monitor]') and OBJECTPROPERTY(id, N'IsUserTable') = 1)
drop table [Lock_monitor]
GO

if not exists (select * from dbo.sysobjects where id = object_id(N'[dbo].[Lock_monitor]') and OBJECTPROPERTY(id, N'IsUserTable') = 1)
 BEGIN
SET ANSI_NULLS ON

SET QUOTED_IDENTIFIER ON

SET ANSI_PADDING ON

CREATE TABLE [dbo].[Lock_monitor](
        [Occurred] [datetime] NOT NULL,
        [Wait_Sec] [bigint] NULL,
        [DB_Name] [varchar](255) NULL,
        [spid] [smallint] NULL,
        [Last_Wait_Type] [nchar](64) NULL,
        [WaitResource] [nchar](256) NULL,
        [hostname] [nchar](128) NULL,
        [program_name] [nchar](128) NULL,
        [hostprocess] [nchar](10) NULL,
        [loginame] [nchar](128) NULL,
        [Waiting_Query] [nvarchar](max) NULL,
        [Blocked_By] [smallint] NULL,
```

```
        [Blocking_Host] [nchar](128) NULL,
        [Blocking_Program] [nchar](128) NULL,
        [Blocking_Host_Process] [nchar](10) NULL,
        [Blocking_User] [nchar](128) NULL,
        [Blocking_Last_Batch] [datetime] NULL,
        [Blocking_Status] [nchar](30) NULL,
        [Blocking_Open_Tran] [smallint] NULL,
        [Blocking_Query] [nvarchar](max) NULL
) ON [PRIMARY]

SET ANSI_PADDING OFF

ALTER TABLE [dbo].[Lock_monitor] ADD  CONSTRAINT [Lock_monitor_Occurred]  DEFAULT (getdate()) FOR [Occurred]
END

GO

-- STEP 2: Create the procedure
IF OBJECT_ID('dbo.usp_Monitor_Locks') IS NOT NULL
BEGIN
   DROP PROCEDURE dbo.usp_Monitor_Locks
   IF OBJECT_ID('dbo.usp_Monitor_Locks') IS NOT NULL
      PRINT '<<< FAILED DROPPING PROCEDURE dbo.usp_Monitor_Locks >>>'
   ELSE
      PRINT '<<< DROPPED PROCEDURE dbo.usp_Monitor_Locks >>>'
END
go
SET QUOTED_IDENTIFIER ON
GO
SET ANSI_NULLS OFF
GO
```

```
CREATE PROCEDURE [dbo].[usp_Monitor_Locks] @BlockingMS [int] = 30000 as
BEGIN

DECLARE		@count int
DECLARE		@iRow int

CREATE TABLE #Temp_Lock_monitor
	(
	 RowId int identity(1, 1),
	 [Wait_Sec] [BIGINT],
	 [DB_Name] [varchar](255),
	 [spid] [smallint],
	 [Last_Wait_Type] [nchar](64),
	 [WaitResource] [nchar](256),
	 [hostname] [nchar](128),
	 [program_name] [nchar](128),
	 [hostprocess] [nchar](10),
	 [loginame] [nchar](128),
	 [Waiting_Query] [nvarchar](max),
	 [Blocked_By] [smallint],
	 [Blocking_Host] [nchar](128),
	 [Blocking_Program] [nchar](128),
	 [Blocking_Host_Process] [nchar](10),
	 [Blocking_User] [nchar](128),
	 [Blocking_Last_Batch] Datetime,
	 [Blocking_Status] nchar(30),
	 [Blocking_Open_Tran] smallint,
	 [Blocking_Query] [nvarchar](max),
	)

INSERT INTO #Temp_Lock_monitor
	  (
```

```
  Wait_Sec,
  [DB_Name],
  spid,
  Last_Wait_Type,
  WaitResource,
  hostname,
  [program_name],
  hostprocess,
  loginame,
  Waiting_Query,
  Blocked_By,
  Blocking_Host,
  Blocking_Program,
  Blocking_Host_Process,
  Blocking_User,
  Blocking_Last_Batch,
  Blocking_Status,
  Blocking_Open_Tran,
  Blocking_Query
)
select  ( p.waittime / 1000 ) as Wait_Sec,
        db_name(p.dbid) as DB_Name,
        p.spid,
        CASE p.lastwaittype
          WHEN 'LCK_M_SCH_S' THEN 'Schema stability'
          WHEN 'LCK_M_SCH_M' THEN 'Schema modification'
          WHEN 'LCK_M_S' THEN 'Share'
          WHEN 'LCK_M_U' THEN 'Update'
          WHEN 'LCK_M_X' THEN 'Exclusive'
          WHEN 'LCK_M_IS' THEN 'Intent-Share'
          WHEN 'LCK_M_IU' THEN 'Intent-Update'
          WHEN 'LCK_M_IX' THEN 'Intent-Exclusive'
```

```
        WHEN 'LCK_M_SIU' THEN 'Shared intent to update'
        WHEN 'LCK_M_SIX' THEN 'Share-Intent-Exclusive'
        WHEN 'LCK_M_UIX' THEN 'Update-Intent-Exclusive'
        WHEN 'LCK_M_BU' THEN 'Bulk Update'
        WHEN 'LCK_M_RS_S' THEN 'Range-share-share'
        WHEN 'LCK_M_RS_U' THEN 'Range-share-Update'
        WHEN 'LCK_M_RI_NL' THEN 'Range-Insert-NULL'
        WHEN 'LCK_M_RI_S' THEN 'Range-Insert-Shared'
        WHEN 'LCK_M_RI_U' THEN 'Range-Insert-Update'
        WHEN 'LCK_M_RI_X' THEN 'Range-Insert-Exclusive'
        WHEN 'LCK_M_RX_S' THEN 'Range-exclusive-Shared'
        WHEN 'LCK_M_RX_U' THEN 'Range-exclusive-update'
        WHEN 'LCK_M_RX_X' THEN 'Range-exclusive-exclusive'
        ELSE p.lastwaittype
    END AS Last_Wait_Type,
    p.waitresource,
    p.hostname,
    p.program_name,
    p.hostprocess,
    p.loginame,
    q.text as Waiting_Query,
    p.blocked AS Blocked_By,
    b.hostname AS Blocking_Host,
    b.program_name AS Blocking_Program,
    b.hostprocess AS Blocking_Host_Process,
    b.loginame As Blocking_User,
    b.last_batch AS Blocking_Last_Batch,
    b.status AS Blocking_Status,
    b.open_tran AS Blocking_Open_Tran,
    bq.text as Blocking_Query
from   master..sysprocesses p
    INNER JOIN master..sysprocesses b ON p.blocked = b.spid
```

```
            cross apply master.sys.dm_exec_sql_text(p.sql_handle)
            as q
            cross apply master.sys.dm_exec_sql_text(b.sql_handle)
            as bq
        where   p.blocked > 0
            and p.waittime > @BlockingMS
            order by p.waittime DESC


SET @count = (@@ROWCOUNT)
If @count > 0
BEGIN
--get array Upper Bound (highest ID number)

--initialize index counter
SET @iRow = 1

--establish loop structure
WHILE @iRow <= @count


        BEGIN
          INSERT  INTO dbastats.dbo.Lock_monitor
              (
                Wait_Sec,
                [DB_Name],
                spid,
                Last_Wait_Type,
                WaitResource,
                hostname,
                [program_name],
                hostprocess,
```

```
    loginame,
    Waiting_Query,
    Blocked_By,
    Blocking_Host,
    Blocking_Program,
    Blocking_Host_Process,
    Blocking_User,
    Blocking_Last_Batch,
                Blocking_Status,
                Blocking_Open_Tran,
    Blocking_Query
)
SELECT  Wait_Sec,
      [DB_Name],
      spid,
      Last_Wait_Type,
      WaitResource,
      hostname,
      [program_name],
      hostprocess,
      loginame,
      Waiting_Query,
      Blocked_By,
      Blocking_Host,
      Blocking_Program,
      Blocking_Host_Process,
      Blocking_User,
      Blocking_Last_Batch,
                  Blocking_Status,
                  Blocking_Open_Tran,
      Blocking_Query
FROM    #Temp_Lock_monitor
```

```
                    WHERE   RowID = @iRow

--go to next row
SET @iRow = @iRow + 1
END

END

drop table #Temp_Lock_monitor

END

GO

SET QUOTED_IDENTIFIER OFF
GO
SET ANSI_NULLS ON
GO
IF OBJECT_ID('dbo.usp_Monitor_Locks') IS NOT NULL
   PRINT '<<< CREATED PROCEDURE dbo.usp_Monitor_Locks >>>'
ELSE
   PRINT '<<< FAILED CREATING PROCEDURE dbo.usp_Monitor_Locks >>>'
go


-- STEP 3: Create the notification TRIGGER. Adjust parameters.
SET QUOTED_IDENTIFIER ON
GO
SET ANSI_NULLS ON
GO

if exists (select * from dbo.sysobjects where id = object_id(N'[dbo].[NOTIFY_LOCK]') and OBJECTPROPERTY(id,
N'IsTrigger') = 1)
```

```
drop trigger [dbo].[NOTIFY_LOCK]
GO

/****** Object:  Trigger [dbo].[NOTIFY_LOCK]    Script Date: 10/09/2009 10:45:29 ******/
SET ANSI_NULLS ON
GO

SET QUOTED_IDENTIFIER OFF
GO


CREATE TRIGGER [dbo].[NOTIFY_LOCK] on [dbo].[Lock_monitor] AFTER INSERT as
declare @msg nvarchar(max)
declare @Sub varchar(256)
declare @sendto varchar(256)

SET @sendto = 'user@address.com'  --need to check and change, can put multiple email seperated by ;

/*this next step is used if you want to include a second email address
when it reaches a certain point.
check the wait_sec below and if above 1200 seconds (20 minutes)
send email to original list above plus add second email list.
this is used because if a process is only blocked for a bit it can be sent to dev group
once it hits a long time others are included to notify of a long running
block and should take action
*/
--If (select wait_sec from inserted) > 1200
--BEGIN
--SET @sendto = @sendto + ';critical@address.com'
--END

set @Sub=(select 'PROCESS LOCKED ON ' + @@ServerName)
```

```
set @msg=(select 'A process blocked has been detected at: '+convert (varchar,Occurred,121)+'

Seconds Blocked: '+ STR(wait_sec) +'
Database: '+ DB_Name + '

_Waiting Process_
Waiting SPID: '+ STR(spid) +'
Last Wait Type: '+ isnull(Last_Wait_Type, '') +'
Wait Resource: '+ isnull(WaitResource, '') +'
host name: '+ isnull(hostname, '') +'
program name: '+ isnull(program_name, '') +'
host process: '+ isnull(hostprocess, '') +'
login name: '+ isnull(loginame, '') +'
Waiting Query: '+ isnull(Waiting_Query, '') +'

_Blocking Process_
SPID: '+ STR(Blocked_By) +'
Host: '+ isnull(Blocking_Host, '') +'
Program: '+ isnull(Blocking_Program, '') +'
Host Process: '+ isnull(Blocking_Host_Process, '') +'
User: '+ isnull(Blocking_User, '') +'
Last Batch: '+ isnull(convert (varchar,Blocking_Last_Batch,121), '') +'
Status: '+ isnull(Blocking_Status, '') +'
Open Tran: '+ isnull(STR(Blocking_Open_Tran), '') +'
Last Query: '+ isnull(Blocking_Query, '') + '
' from inserted)


EXEC msdb.dbo.sp_send_dbmail
@profile_name = 'SqlDba',  --need to check and change
@recipients = @sendto,
@subject = @Sub,
```

```
@body = @msg

GO



--STEP 4: Create scheduled job
USE [msdb]
GO

/****** Object:  Job [Monitor Locks]    Script Date: 10/09/2009 11:10:29 ******/
BEGIN TRANSACTION
DECLARE @ReturnCode INT
SELECT @ReturnCode = 0
/****** Object:  JobCategory [[Uncategorized (Local)]]]    Script Date: 10/09/2009 11:10:29 ******/
IF NOT EXISTS (SELECT name FROM msdb.dbo.syscategories WHERE name=N'[Uncategorized (Local)]' AND
category_class=1)
BEGIN
EXEC @ReturnCode = msdb.dbo.sp_add_category @class=N'JOB', @type=N'LOCAL', @name=N'[Uncategorized (Local)]'
IF (@@ERROR <> 0 OR @ReturnCode <> 0) GOTO QuitWithRollback

END

DECLARE @jobId BINARY(16)
EXEC @ReturnCode =  msdb.dbo.sp_add_job @job_name=N'Monitor Locks',
                    @enabled=1,
                    @notify_level_eventlog=0,
                    @notify_level_email=0,
                    @notify_level_netsend=0,
                    @notify_level_page=0,
                    @delete_level=0,
                    @description=N'Run every minute to look for any queries blocking others for greater than @BlockingMS is
set to.  @BlockingMS is milliseconds variable to check against',
```

```
                @category_name=N'[Uncategorized (Local)]',
                @owner_login_name=N'sa', @job_id = @jobId OUTPUT
IF (@@ERROR <> 0 OR @ReturnCode <> 0) GOTO QuitWithRollback
/****** Object:  Step [Check Blocking Locks]    Script Date: 10/09/2009 11:10:31 ******/
EXEC @ReturnCode = msdb.dbo.sp_add_jobstep @job_id=@jobId, @step_name=N'Check Blocking Locks',
                @step_id=1,
                @cmdexec_success_code=0,
                @on_success_action=1,
                @on_success_step_id=0,
                @on_fail_action=2,
                @on_fail_step_id=0,
                @retry_attempts=0,
                @retry_interval=0,
                @os_run_priority=0, @subsystem=N'TSQL',
                @command=N'EXEC dbastats.dbo.usp_Monitor_Locks @BlockingMS=30000',
                @database_name=N'dbastats',
                @flags=0
IF (@@ERROR <> 0 OR @ReturnCode <> 0) GOTO QuitWithRollback
EXEC @ReturnCode = msdb.dbo.sp_update_job @job_id = @jobId, @start_step_id = 1
IF (@@ERROR <> 0 OR @ReturnCode <> 0) GOTO QuitWithRollback
EXEC @ReturnCode = msdb.dbo.sp_add_jobschedule @job_id=@jobId, @name=N'Every Minute',
                @enabled=1,
                @freq_type=4,
                @freq_interval=1,
                @freq_subday_type=4,
                @freq_subday_interval=1,
                @freq_relative_interval=0,
                @freq_recurrence_factor=0,
                @active_start_date=20091001,
                @active_end_date=99991231,
                @active_start_time=30,
                @active_end_time=235959
```

```
IF (@@ERROR <> 0 OR @ReturnCode <> 0) GOTO QuitWithRollback
EXEC @ReturnCode = msdb.dbo.sp_add_jobserver @job_id = @jobId, @server_name = N'(local)'
IF (@@ERROR <> 0 OR @ReturnCode <> 0) GOTO QuitWithRollback
COMMIT TRANSACTION
GOTO EndSave
QuitWithRollback:
   IF (@@TRANCOUNT > 0) ROLLBACK TRANSACTION
EndSave:

GO
```

7.8 Dsg_CleanupSec

This stored procedure needs to be created in each security database and should be scheduled to run once per week with an appropriate @DaysToKeep (typically seven to 30 days).

```
use DCFSec_Demo
GO
IF EXISTS
  (SELECT name
   FROM sysobjects
   WHERE name = 'dsg_CleanupSec' AND type = 'P')
DROP PROCEDURE dsg_CleanupSec
GO
IF EXISTS
  (SELECT name
   FROM sysobjects
   WHERE name = 'dsg_PurgeInBlocks' AND type = 'P')
DROP PROCEDURE dsg_PurgeInBlocks
GO

create proc dbo.dsg_PurgeInBlocks (@tablename nvarchar(256), @daystokeep int, @dopurge bit = 0, @idfield
nvarchar(256) = '', @batchsize int = 1000, @batchdelaysec int = 1, @datecol nvarchar(256) =
'isnull(createdate,modifydate)')
```

```
AS
BEGIN
	declare @strsql nvarchar(1024)
	declare @waitdelay datetime

	IF (@IDField is null or @IDField='')
	BEGIN
		set @IDField=@tablename+'ID'
	END

	if (@batchsize = 0)
	BEGIN
		set @batchsize=1000
	END
	create table #IDToPurge (ID int, batchnum int)

	declare @wasexception bit
	set @wasexception= 0

	BEGIN TRY

		set @strsql = 'INSERT INTO #IDToPurge (ID,BatchNum) select '+@IDField+', convert(int,(RANK() over
(order by '+@IDField+'))/'+convert(varchar,@BatchSize)+') from '+@tablename+' with (NOLOCK) where
datediff(d,'+@datecol+',GETDATE()) > '+convert(varchar,@daystokeep)+' order by '+@datecol
		print @strsql
		exec sp_executesql @strsql


		declare @rowstopurge int, @batches int
		select @rowstopurge=COUNT(*) , @batches=MAX(batchnum) from #IDToPurge

		print 'Rows to purge: '+convert(varchar,@rowstopurge)+', Batches: '+convert(varchar,@batches)
```

```
		set @waitdelay = DATEADD(s,@batchdelaysec,'00:00')


		declare @curbatch int
		set @curbatch = 0
		while (@curbatch <= @batches)
		BEGIN
			--set @strsql = 'select COUNT(*), MIN(fwordertrackingID), MAX(fwordertrackingid) from
'+@tablename+' where '+@idfield+' in (select ID from #IDToPurge where batchnum='+convert(varchar,@curbatch)+')'
			set @strsql = 'delete from '+@tablename+' where '+@idfield+' in (select ID from #IDToPurge
where batchnum='+convert(varchar,@curbatch)+')'
			--select COUNT(*), MIN(fwordertrackingID), MAX(fwordertrackingid) from FWOrderTracking
where FWOrderTrackingID in (select ID from #IDToPurge where batchnum=@curbatch)
			print @strsql
			if (@dopurge=1)
			BEGIN
				exec sp_executesql @strsql
			END
			ELSE
			BEGIN
				declare @cnt int, @mino int, @maxo int

				select @cnt=COUNT(*), @mino=MIN(ID), @maxo=MAX(ID) from #IDToPurge where
batchnum=@curbatch
				PRINT 'Not purging, would have removed: '+str(@cnt)+', starting with '+str(@mino)+',
ending with '+str(@maxo)
			END
			set @curbatch = @curbatch+1
			WAITFOR DELAY @waitdelay
		END

	END TRY
	BEGIN CATCH
		set @wasexception=1
		drop table #IDToPurge
```

```
                PRINT 'EXCEPTION has occurred in '+isnull(ERROR_Procedure(),'X')+' for '+isnull(@tablename,'')
                PRINT convert(varchar,ERROR_NUMBER())+' - '+ERROR_MESSAGE()
        END CATCH

        IF (@wasexception=0)
        BEGIN
                drop table #IDToPurge
        END
END
GO



CREATE PROCEDURE dbo.dsg_CleanupSec
  @daysToKeep int,
  @dopurge bit = 1,
  @batchsize int = 1000,
  @batchdelaysec int = 1
AS

BEGIN
        DECLARE @LogMsg varchar(2048)
        --if @NbrOfDaysToKeep is below 90, generate error and return
        IF (@daysToKeep < 7)
        BEGIN
          SET @LogMsg = 'ERROR: @daysToKeep value has to be at least 90. @daysToKeep value specified: ' +
cast(@daysToKeep as varchar(32)) +
                        '. Procedure terminating. No changes made.'
          RAISERROR(@LogMsg,16,1)
          RETURN 1
        END

  -- Create the keep date
  DECLARE @keepDate datetime
```

```
    SET @keepDate = DATEADD(d, -@daysToKeep, GetDate())

    -- Delete CtyMsgTraceData
        exec dbo.dsg_PurgeInBlocks @tablename ='CtyMsgTraceData', @daystokeep =@daysToKeep, @dopurge =
@dopurge, @idfield= 'MsgTraceID', @batchsize = @batchsize, @batchdelaysec =@batchdelaysec, @datecol =
'modifieddate'

    -- Delete CtyMsgTrace
    exec dbo.dsg_PurgeInBlocks @tablename ='CtyMsgTrace', @daystokeep =@daysToKeep, @dopurge = @dopurge,
@idfield= 'MsgTraceID', @batchsize = @batchsize, @batchdelaysec =@batchdelaysec, @datecol = 'modifydate'

    -- Delete CtyMsgLogParm
        exec dbo.dsg_PurgeInBlocks @tablename ='CtyMsgLogParm', @daystokeep =@daysToKeep, @dopurge =
@dopurge, @idfield= 'MsgLogID', @batchsize = @batchsize, @batchdelaysec =@batchdelaysec, @datecol = 'modifydate'

    -- Delete CtyMsgLog
    exec dbo.dsg_PurgeInBlocks @tablename ='CtyMsgLog', @daystokeep =@daysToKeep, @dopurge = @dopurge,
@idfield= 'MsgLogID', @batchsize = @batchsize, @batchdelaysec =@batchdelaysec, @datecol = 'modifydate'

END
GO
```

7.9 Dsg_CleanupFW

This stored procedure needs to be created in each Route Planner database and should be scheduled at least once per week, this clears out the tracking and bgo history tables. It should be configured with an appropriate @daysToKeep (typically seven to 30 days).

```
--USE LNOSFW_Acme
IF EXISTS
  (SELECT name
   FROM sysobjects
   WHERE name = 'dsg_CleanupFW' AND type = 'P')
DROP PROCEDURE dsg_CleanupFW
GO
IF EXISTS
  (SELECT name
```

```
  FROM sysobjects
  WHERE name = 'dsg_PurgeInBlocks' AND type = 'P')
DROP PROCEDURE dsg_PurgeInBlocks
GO



create proc dsg_PurgeInBlocks (@tablename nvarchar(256), @daystokeep int, @dopurge bit = 0, @idfield nvarchar(256) =
'', @batchsize int = 1000, @batchdelaysec int = 1, @datecol nvarchar(256) = 'isnull(createdate,modifydate)')
AS
BEGIN
        declare @strsql nvarchar(1024)
        declare @waitdelay datetime

        IF (@IDField is null or @IDField='')
        BEGIN
                set @IDField=@tablename+'ID'
        END

        if (@batchsize = 0)
        BEGIN
                set @batchsize=1000
        END
        create table #IDToPurge (ID int, batchnum int)

        declare @wasexception bit
        set @wasexception= 0

        BEGIN TRY

                set @strsql = 'INSERT INTO #IDToPurge (ID,BatchNum) select '+@IDField+', convert(int,(RANK() over
(order by '+@IDField+'))/'+convert(varchar,@BatchSize)+') from '+@tablename+' with (NOLOCK) where
datediff(d,'+@datecol+',GETDATE()) > '+convert(varchar,@daystokeep)+' order by '+@datecol
                print @strsql
```

```
exec sp_executesql @strsql



declare @rowstopurge int, @batches int
select @rowstopurge=COUNT(*) , @batches=MAX(batchnum) from #IDToPurge

print 'Rows to purge: '+convert(varchar,@rowstopurge)+', Batches: '+convert(varchar,@batches)

set @waitdelay = DATEADD(s,@batchdelaysec,'00:00')

declare @curbatch int
set @curbatch = 0
while (@curbatch <= @batches)
BEGIN
	--set @strsql = 'select COUNT(*), MIN(fwordertrackingID), MAX(fwordertrackingid) from
'+@tablename+' where '+@idfield+' in (select ID from #IDToPurge where batchnum='+convert(varchar,@curbatch)+')'
	set @strsql = 'delete from '+@tablename+' where '+@idfield+' in (select ID from #IDToPurge
where batchnum='+convert(varchar,@curbatch)+')'
	--select COUNT(*), MIN(fwordertrackingID), MAX(fwordertrackingid) from FWOrderTracking
where FWOrderTrackingID in (select ID from #IDToPurge where batchnum=@curbatch)
	print @strsql
	if (@dopurge=1)
	BEGIN
		exec sp_executesql @strsql
	END
	ELSE
	BEGIN
		declare @cnt int, @mino int, @maxo int

		select @cnt=COUNT(*), @mino=MIN(ID), @maxo=MAX(ID) from #IDToPurge where
batchnum=@curbatch
		PRINT 'Not purging, would have removed: '+str(@cnt)+', starting with '+str(@mino)+',
ending with '+str(@maxo)
	END
```

```
                set @curbatch = @curbatch+1
                WAITFOR DELAY @waitdelay
            END

        END TRY
        BEGIN CATCH
            set @wasexception=1
            drop table #IDToPurge
            PRINT 'EXCEPTION has occurred in '+isnull(ERROR_Procedure(),'X')+' for '+isnull(@tablename,'')
            PRINT convert(varchar,ERROR_NUMBER())+' - '+ERROR_MESSAGE()
        END CATCH

        IF (@wasexception=0)
        BEGIN
            drop table #IDToPurge
        END
END
GO

CREATE PROCEDURE dbo.dsg_CleanupFW
  @daysToKeep int,
  @dopurge bit = 1,
  @batchsize int = 1000,
  @batchdelaysec int = 1
AS

BEGIN

        SET NOCOUNT ON

        DECLARE @MinDaysToKeep int
        set @MinDaysToKeep=7
```

```
        DECLARE @LogMsg varchar(2048)
        --if @NbrOfDaysToKeep is below 7, generate error and return
        IF (@daysToKeep < @MinDaysToKeep)
        BEGIN
          SET @LogMsg = 'ERROR: @daysToKeep value has to be at least '+CONVERT(nvarchar,@MinDaysToKeep)+'.
@daysToKeep value specified: ' +  cast(@daysToKeep as varchar(32)) +
                    '. Procedure terminating. No changes made.'
          RAISERROR(@LogMsg,16,1)
          RETURN 1
        END

   -- Create the keep date
--    DECLARE @keepDate datetime
--    SET @keepDate = DATEADD(d, -@daysToKeep, GetDate())

   -- Delete Tracking Tables

   exec dbo.dsg_PurgeInBlocks @tablename ='FWOrderTracking', @daystokeep =@daysToKeep, @dopurge = @dopurge,
@idfield= 'FWOrderTrackingID', @batchsize = @batchsize, @batchdelaysec =@batchdelaysec, @datecol =
'isnull(createdate,modifydate)'

        exec dbo.dsg_PurgeInBlocks @tablename ='FWScheduleTracking', @daystokeep =@daysToKeep, @dopurge =
@dopurge, @idfield= 'FWScheduleTrackingID', @batchsize = @batchsize, @batchdelaysec =@batchdelaysec, @datecol =
'isnull(createdate,modifydate)'

        exec dbo.dsg_PurgeInBlocks @tablename ='FWPublishRouteTracking', @daystokeep =@daysToKeep, @dopurge =
@dopurge, @idfield= 'RouteTrackingID', @batchsize = @batchsize, @batchdelaysec =@batchdelaysec, @datecol =
'isnull(createdate,modifydate)'

        exec dbo.dsg_PurgeInBlocks @tablename ='FWDataSetGroupHist', @daystokeep =@daysToKeep, @dopurge =
@dopurge, @idfield= 'DataSetGroupHistID', @batchsize = @batchsize, @batchdelaysec =@batchdelaysec, @datecol =
'isnull(createdate,modifydate)'

END
```

```
GO


--exec dbo.dsg_CleanupFW 30,0,0
```

7.10 Descartes AltaMap Performance Benchmark

To verify Descartes AltaMap is performing at peak conditions the following benchmark was developed.

The performance of matrix's depend on primarily on CPU and IO performance, the requirements vary by size of matrix.

- Small matrix's (< 100) are significantly influenced by IO Read latency and CPU capacity
- Medium Matrix's (>=100, <400) are primarily influenced by CPU capacity
- Large Matrix's (> 500) are most significantly influed by CPU but are also influenced by IO Write and Read Latency.

The following table provides a testing URL as well as expected runtime. Each test should be run 3x to account for variability, variability is much more likely in a virtual environment. In a virtual environment this should be tested both "under load" and "idle" to ensure problems are not encountered during rollout.

➲ **Note—** The very first request may take an extract three to five seconds while the service "warms up".

URL	# Stops	DSG – 16 core phys + RAMDISK Elapsed Time (ms)
http://localhost/mapeditor/tests/testgetdistancematrix10.aspx	10	272
http://localhost/mapeditor/tests/testgetdistancematrix.aspx	20	535
http://localhost/mapeditor/tests/testgetdistancematrix100.aspx	100	6704
http://localhost/mapeditor/tests/testgetdistancematrix200.aspx	200	27630
http://localhost/mapeditor/tests/testgetdistancematrix300.aspx	300	56657
http://localhost/mapeditor/tests/testgetdistancematrix400.aspx	400	85507
http://localhost/mapeditor/tests/testgetdistancematrix500.aspx	500	136812

http://localhost/mapeditor/tests/testgetdistancematrix1000.aspx	1000	Over 600 seconds

7.11 Descartes AltaMap Performance under KVM

Based on extensive testing of Descartes AltaMap under Linux KVM it has been determined that it is not a good fit. The following table and graph illustrates the performance of a static Descartes AltaMap calculation of small to medium size. Under physical hardware it there is less than 1 percent variance however under KVM it has a variance of up to 180 percent.

In the following graph there are three sets of points representing the same task running on two VM's on an "idle" host, the two VM's tests were staggered so there is no competition between them. The VM was 16 vCPU and is running on a physical host with 64 HT cores. The test has been performed every 15 minutes and the runtime of each has been recorded.

Based on this information, three distinct runtimes were found.

- Fast = ~ benchmark target
- Medium = ~80 percent longer than benchmark
- Slow = ~160 percent longer than benchmark

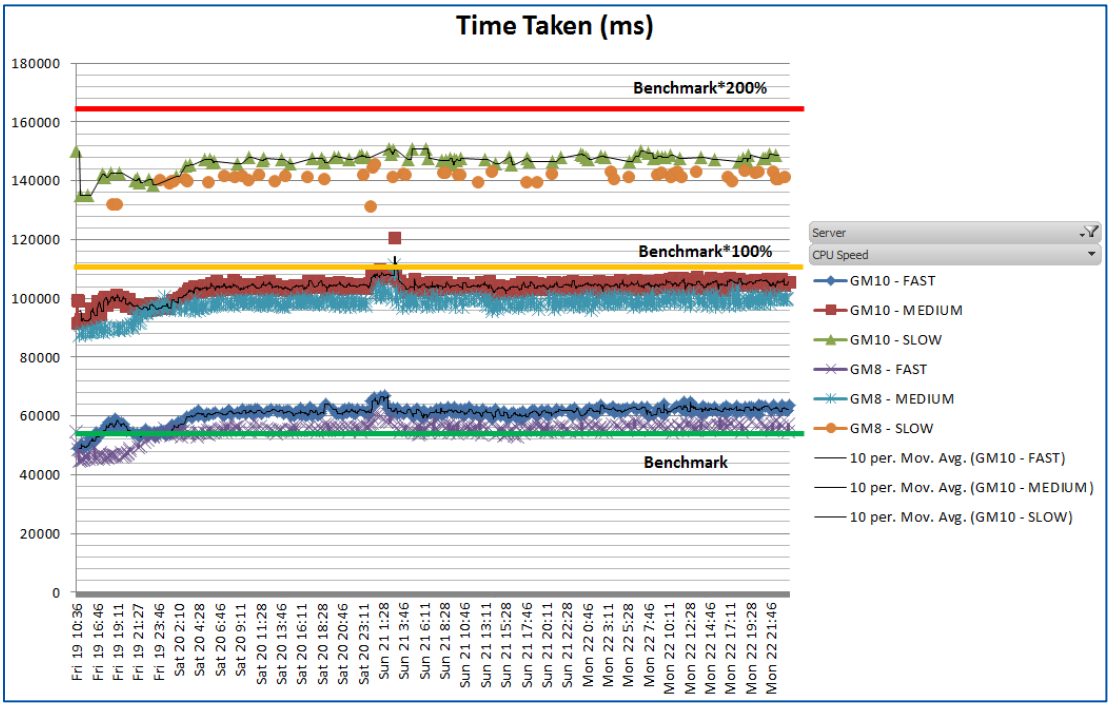
The target benchmark was 55 seconds on a production class machine.

Row Labels	Average of TimeTaken	StdDev of TimeTaken	% Of Requests
FAST	60,383	3,027	37.24%
MEDIUM	103,592	2,976	54.18%
SLOW	146,582	3,123	8.57%
Summary	**91,184**	**26,638**	**100.00%**

As you can see more than 60 percent of the time it takes at least 80 percent longer than the benchmark.

Also of note is that in each of the runtime bands the variability is minimal (less than five percent) which indicates it is a problem with the state of the Virtual Machine.

The following graph shows the individual runtimes by server and speed category.

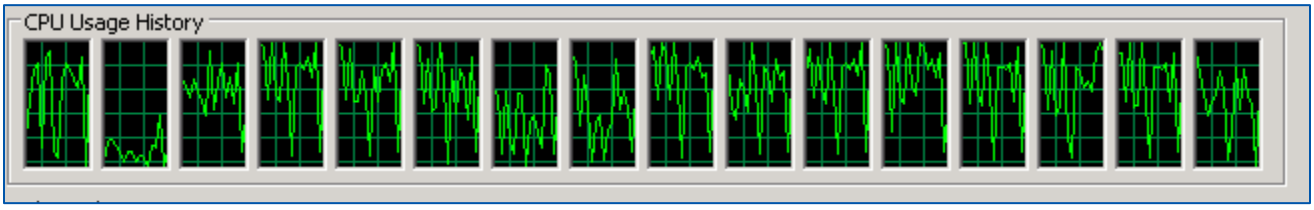


In this it is clear that there are three distinct runtimes and that the performance is very consistent in each band.

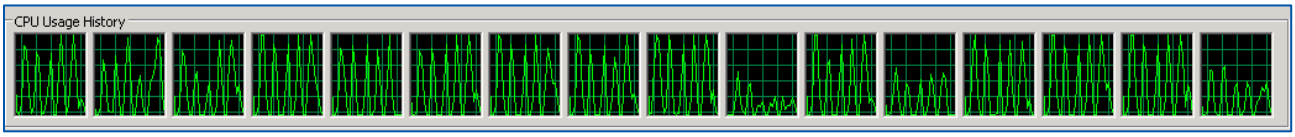
Due to the inability to achieve a consistent runtime at the expected benchmark **KVM is not supported as a virtualization platform for Descartes AltaMap**.

During these slowdowns the CPU utilization graph is completely different from "normal".

Here is a typical CPU graph:



Here is the same request under the "slow down":



In the second graph it can be seen that 50 percent of the time the CPU usage drops to 0.

7.12 IIS Recycle Tuning and Logging

The following script can be used to enable logging of all application recycles, in addition it adjust the recycle threshold as the installer default (14.1.4 and earlier) has been determined to be too low for medium-large implementations. Modification ofthis script can allow individual environment fine tuning.

LNOS Server Descartes Route Planner Recycling.cmd

```
%windir%\system32\inetsrv\appcmd set apppool /apppool.name:LNOSFW
/recycling.periodicRestart.requests:200000

%windir%\system32\inetsrv\appcmd set apppool /apppool.name:STAD
/recycling.periodicRestart.requests:200000


%windir%\system32\inetsrv\appcmd set config /section:applicationPools
/[name='LNOSFW'].recycling.logEventOnRecycle:PrivateMemory

%windir%\system32\inetsrv\appcmd set config /section:applicationPools
/[name='LNOSFW'].recycling.logEventOnRecycle:Memory

%windir%\system32\inetsrv\appcmd set config /section:applicationPools
/[name='LNOSFW'].recycling.logEventOnRecycle:Schedule

%windir%\system32\inetsrv\appcmd set config /section:applicationPools
/[name='LNOSFW'].recycling.logEventOnRecycle:Requests

%windir%\system32\inetsrv\appcmd set config /section:applicationPools
/[name='LNOSFW'].recycling.logEventOnRecycle:Time

%windir%\system32\inetsrv\appcmd set config /section:applicationPools
/[name='STAD'].recycling.logEventOnRecycle:PrivateMemory

%windir%\system32\inetsrv\appcmd set config /section:applicationPools
/[name='STAD'].recycling.logEventOnRecycle:Memory

%windir%\system32\inetsrv\appcmd set config /section:applicationPools
/[name='STAD'].recycling.logEventOnRecycle:Schedule

%windir%\system32\inetsrv\appcmd set config /section:applicationPools
/[name='STAD'].recycling.logEventOnRecycle:Requests

%windir%\system32\inetsrv\appcmd set config /section:applicationPools
/[name='STAD'].recycling.logEventOnRecycle:Time


@echo **** this script will only work if Descartes Route Planner is already installed
```

pause

7.13 Server Setup Scripts

7.13.1 Pre-Configuration Windows® PowerShell Script

7.13.1.1 Supporting Functions

```
function Grant-LogonAsAServiceRight
{
        <#
        .Synopsis
           Grants the provided account(s) the "Logon as a Service" right
        .DESCRIPTION
           Grants the provided account(s) the "Logon as a Service" right
        .EXAMPLE
           Grant-LogonAsAServiceRight @("Acme\serviceuser1","Acme\serviceUser2")

           Grants the logon as a service right for users Acme\ServiceUser1 & 2
        .EXAMPLE
           @("Acme\serviceuser1","Acme\serviceUser2") | Grant-LogonAsAService

          Grants the logon as a service right for users Acme\ServiceUser1 & 2
        .EXAMPLE
                if (!($cred))
                {
                        $cred = Get-Credential acme\serviceuser
                }
                @("Server1","Server2","Server3","Server4") | % {
                        Invoke-Command -ComputerName $_ `
                         -Credential $cred -ScriptBlock (get-item function:Grant-LogonAsAServiceRight).ScriptBlock
`
                         -ArgumentList "acme\serviceuser"
                 }

                Grants the logon as a service right to Acme\ServiceUser on server 1-4
        .OUTPUTS
           *NONE*
        .NOTES
```

```
  VERSION: 1.1
  COMMENT: rewrite as function , improve error handling, eliminate write-host, support pipeline
  AUTHOR: Justin Marshall
  VERSION: 1.0
  COMMENT: INITIAL DRAFT, http://blog.karstein-consulting.com
  AUTHOR: Ingo Karstein
#>
param(

[Parameter(Mandatory=$true,ValueFromPipeline=$true,ValueFromPipeLineByPropertyName=$true,Position=1)]
        [string[]]$AccountsToAdd
)
begin
{}
process {
        foreach ($AccountToAdd in $AccountsToAdd) {
                $sidstr = $null
                try {
                        $ntprincipal = new-object System.Security.Principal.NTAccount "$accountToAdd"
                        $sid = $ntprincipal.Translate([System.Security.Principal.SecurityIdentifier])
                        $sidstr = $sid.Value.ToString()
                } catch {
                        $sidstr = $null
                }

                Write-Verbose "Account: $($accountToAdd)" #-ForegroundColor DarkCyan

                if( [string]::IsNullOrEmpty($sidstr) ) {
                        Write-Verbose "Account not found!" #-ForegroundColor Red
                        throw "Account not found!"
                }

                Write-Verbose "Account SID: $($sidstr)" #-ForegroundColor DarkCyan

                $tmp = [System.IO.Path]::GetTempFileName()

                Write-Verbose "Export current Local Security Policy" #-ForegroundColor DarkCyan
```

```
$Result = secedit.exe /export /cfg "$($tmp)"
try
{
        Write-Verbose "Export Result was [$Result]"
        if (!($Result -match "completed successfully"))
        {
                Write-Error $Result
                throw "Unable to Export local security Policy!"
        }

        $c = Get-Content -Path $tmp
} finally {
        Remove-Item $tmp
}
$currentSetting = ""

foreach($s in $c) {
        if( $s -like "SeServiceLogonRight*") {
                $x = $s.split("=",[System.StringSplitOptions]::RemoveEmptyEntries)
                $currentSetting = $x[1].Trim()
        }
}

if( $currentSetting -notlike "*$($sidstr)*" ) {
        Write-Verbose "Modify Setting ""Logon as a Service""" #-ForegroundColor DarkCyan

        if( [string]::IsNullOrEmpty($currentSetting) ) {
                $currentSetting = "*$($sidstr)"
        } else {
                $currentSetting = "*$($sidstr),$($currentSetting)"
        }

        Write-Verbose "$currentSetting"

        $outfile = @"
[Unicode]
```

```
Unicode=yes
[Version]
signature="`$CHICAGO`$"
Revision=1
[Privilege Rights]
SeServiceLogonRight = $($currentSetting)
"@

                                $tmp2 = [System.IO.Path]::GetTempFileName()


                                Write-Verbose "Import new settings to Local Security Policy" #-ForegroundColor
DarkCyan
                                $outfile | Set-Content -Path $tmp2 -Encoding Unicode -Force

                                #notepad.exe $tmp2
                                Push-Location (Split-Path $tmp2)

                                try {
                                        $result = secedit.exe /configure /db "secedit.sdb" /cfg "$($tmp2)" /areas
USER_RIGHTS
                                        if (!($Result -match "completed successfully"))
                                        {
                                                Write-Error $Result
                                                throw "Unable to Reconfigure local security Policy!"
                                        }
                                        write-Debug "secedit.exe /configure /db ""secedit.sdb"" /cfg ""$($tmp2)""
/areas USER_RIGHTS "
                                } finally {
                                        Pop-Location
                                        Remove-Item $tmp2
                                }
                        } else {
                                Write-Warning "NO ACTIONS REQUIRED! Account already in ""Logon as a Service"" on
$env:COMPUTERNAME" #-ForegroundColor DarkCyan
                        }

                        Write-verbose "Done."
```

```
                }
        }
        end {}
}
function Write-ChildProgress
{
        <#
        .Synopsis
           Writes to a progress bar and automatically handles if a parent is provided or not.
        .DESCRIPTION
           Replaces the standard write-progress function and wraps it to allow an optional
                parent parameter. and passess provided parameters to the core write-progress
        function based on the input parameters.
        .EXAMPLE
           write-progress -Activity Working -Status "working on $env:computername"

           writes to the default (current) progress bar
        .EXAMPLE
           write-progress -Activity Working -Status "working on $env:computername" -ParentID 0

           writes to a progress bar that is a child of ParentID provided (0)
        .EXAMPLE
           write-progress -Activity Completed -Status "Completed on $env:computername" -Completed

          completed the default (current) progress bar
        .OUTPUTS
           *NONE*
        .NOTES
          VERSION: 1.0
          COMMENT: INITIAL DRAFT
          AUTHOR: Justin Marshall
        #>

        Param($Activity,$Status,$percentComplete,$ParentID,[switch]$Completed)

        $parms = @{
```

```
        Activity=$Activity
        Status=$Status
        }
        if ($percentComplete -ge 0) { $parms['PercentComplete'] = $percentComplete}
        if ($Completed) { $parms['Completed'] = $true}

        Write-Progress @parms
}

function Install-LNOSOSRequirements
{
        <#
        .Synopsis
           Installs OS requirements for LNOS applications
        .DESCRIPTION
           Installs the OS requirement for LNOS Applications
        .EXAMPLE
           Install-LNOSOSrequirements

           Installs the OS requirements on the local server.
        .EXAMPLE

                @("Server1","Server2","Server3","Server4") | Install-LNOSOSrequirements

                Installs the OS requirements on the provided remote servers.
        .OUTPUTS
           *NONE*
        .NOTES
          VERSION: 1.0
          COMMENT: INITIAL DRAFT
          AUTHOR: Jusitn Marshall
        #>

        Param(
                [Parameter(ValueFromPipeline=$true,Mandatory=$false,Position=1)]
                [Alias("CN")]
```

```
		[string[]]$ComputerName,
		[int]$ProgressParentID
	)
	begin {
		$installlist = '^powershell|^Web|^NET|^Web|^MSMQ|^WAS'
		$excludelist = @('Web-WebSockets','Web-CGI','Web-AppInit','Web-CertProvider','Web-DAV-
Publishing','NET-HTTP-Activation','NET-Non-HTTP-Activ','MSMQ-Directory','MSMQ-HTTP-Support','MSMQ-Triggers','MSMQ-
Multicasting','MSMQ-Routing','MSMQ-DCOM','DSC-Service','WindowsPowerShellWebAccess','Web-WHC','web-ftp-
server','web-ftp-service','web-ftp-ext','web-application-proxy')
		$i = 0 #counting number of servers to check if list provided and track progress

		Write-ChildProgress -activity InstallingOSFeatures -Status "Initializing" -PercentComplete 0 -
ParentId $ProgressParentID

		$WinVer = [System.Environment]::OSVersion.Version
		[bool]$Is2012 = ($WinVer.Major -gt 6 -or #windows 10
			($WinVer.Major -eq 6 -and $WinVer.Minor -ge 2) #windows 2012 or R2
			)
		if (!$Is2012)
		{
			Write-ChildProgress -Activity InstallingOSFeatures -Status "Aborting"  -ParentId
$ProgressParentID -Completed
			throw "OS Version not supported, must be windows 2012 or later"
		}
	}
	process {

		#only process non-empty server's in the list
		$ComputerName | where {!([string]::IsNullOrWhiteSpace($_))} |
			foreach-object {
				$i++
				$server = $_
				Write-ChildProgress -activity InstallingOSFeatures -Status "Installing on
$Server" -PercentComplete $i  -ParentId $ProgressParentID
				Get-WindowsFeature | where{$_.name -match $installlist -and $_.name -notin
$excludelist} | Install-WindowsFeature -IncludeManagementTools -cn $Server | select @{n='Server';e={$Server}},*
			}

	}#process
```

```
        end {
                #no server list
                if ($i -eq 0)
                {
                        Get-WindowsFeature | where{$_.name -match $installlist -and $_.name -notin $excludelist} |
Install-WindowsFeature -IncludeManagementTools | select @{n='Server';e={$env:COMPUTERNAME}},*
                }
                Write-ChildProgress -Activity InstallingOSFeatures -completed  -ParentId $ProgressParentID
        }
}


function Install-LNOSRDPMultipleSessions
{
        <#
        .Synopsis
           Enables multiple RDP sessions for the same user
        .DESCRIPTION
           Enables multiple RDP sessions for the same user
        .EXAMPLE
           Install-LNOSOSrequirements

           Enables multiple RDP sessions for the same user on the local server.
        .EXAMPLE

                @("Server1","Server2","Server3","Server4") | Install-LNOSOSrequirements

                Enables multiple RDP sessions for the same user on the provided remote servers.
        .OUTPUTS
           *NONE*
        .NOTES
          VERSION: 1.0
          COMMENT: INITIAL DRAFT
          AUTHOR: Jusitn Marshall
        #>

        Param(
```

```
        [Parameter(ValueFromPipeline=$true,Mandatory=$false,Position=1)]
        [Alias("CN")]
        [string[]]$ComputerName,
        [int]$ProgressParentID
    )
    begin {
        $i=0


        [Scriptblock]$setRDPSB = {
            $RDPpath = 'HKLM:\SYSTEM\CurrentControlSet\Control\Terminal Server'

            $MSRDPConfig1 = @()
            $MSRDPConfig1 +=
@{Path=$RDPpath;Name='fSingleSessionPerUser';Value=0x0;PropertyType="DWord"}

            $MSRDPConfig1 | %{$_['Path'] } | select -Unique |
                ForEach-Object {
                    if (!(Get-Item -Path $_))
                    {
                        New-Item -Path $_
                    }
                }

            $MSRDPConfig1 | % { (new-object PSObject -property $_) } |
                ForEach-Object {
                    if ($_ | Get-ItemProperty )
                    {
                        $_ | Set-ItemProperty
                    }
                    else
                    {
                        $_ | New-ItemProperty
                    }
                }

        }
```

```
                Write-ChildProgress -activity "Configuring RDP Sessions" -Status "Initializing" -PercentComplete 0
-ParentId $ProgressParentID


        }
        process {
                $ComputerName | where {!([string]::IsNullOrWhiteSpace($_))} |
                        foreach-object {
                                $i++
                                $server = $_
                                Write-ChildProgress -activity "Configuring RDP Sessions" -Status "Installing on
$Server" -PercentComplete $i  -ParentId $ProgressParentID
                                Invoke-Command -ComputerName $server -ScriptBlock $setRDPSB
                        }
        }#process
        end {
                #no server list
                if ($i -eq 0)
                {
                        Invoke-Command -ScriptBlock $setRDPSB
                }
                Write-ChildProgress -Activity "Configuring RDP Sessions" -completed  -ParentId $ProgressParentID
        }
}

function Install-LNOSMSDTCRequirements
{
        <#
        .Synopsis
           Enables DTC settings required by LNOS
        .DESCRIPTION
           Enables DTC settings required by LNOS
        .EXAMPLE
           Install-LNOSMSDTCRequirements


           Enables DTC settings required by LNOS on the local server.
        .EXAMPLE
```

```
        @("Server1","Server2","Server3","Server4") | Install-LNOSMSDTCRequirements

        Enables DTC settings required by LNOS on the provided remote servers.
    .OUTPUTS
       *NONE*
    .NOTES
      VERSION: 1.0
      COMMENT: INITIAL DRAFT
      AUTHOR: Jusitn Marshall
    #>
    Param(
        [Parameter(ValueFromPipeline=$true,Mandatory=$false,Position=1)]
        [Alias("CN")]
        [string[]]$ComputerName,
        [int]$ProgressParentID
    )
    begin {
        $i=0


        [Scriptblock]$setDTCSB = {
            $dtcpath = 'HKLM:\SOFTWARE\Microsoft\MSDTC'


            $MSDTCConfig1 = @()
            $MSDTCConfig1 +=
@{Path=$dtcpath;Name='AllowOnlySecureRpcCalls';Value=0x0;PropertyType="DWord"}
            $MSDTCConfig1 +=
@{Path=$dtcpath;Name='FallbackToUnsecureRPCIfNecessary';Value=0x00000000;PropertyType="DWord"}
            $MSDTCConfig1 += @{Path=$dtcpath;Name='MaxLogSize';Value=0x00000200;PropertyType="DWord"}
            $MSDTCConfig1 +=
@{Path=$dtcpath;Name='TurnOffRpcSecurity';Value=0x00000001;PropertyType="DWord"}


            $MSDTCConfig1 +=
@{Path="$dtcpath\Security";Name='DomainControllerState';Value=0x00000000;PropertyType="DWord"}
            $MSDTCConfig1 +=
@{Path="$dtcpath\Security";Name='LuTransactions';Value=0x00000001;PropertyType="DWord"}
            $MSDTCConfig1 +=
@{Path="$dtcpath\Security";Name='NetworkDtcAccess';Value=0x00000001;PropertyType="DWord"}
```

```
                        $MSDTCConfig1 +=
@{Path="$dtcpath\Security";Name='NetworkDtcAccessAdmin';Value=0x00000001;PropertyType="DWord"}
                        $MSDTCConfig1 +=
@{Path="$dtcpath\Security";Name='NetworkDtcAccessClients';Value=0x00000001;PropertyType="DWord"}
                        $MSDTCConfig1 +=
@{Path="$dtcpath\Security";Name='NetworkDtcAccessInbound';Value=0x00000001;PropertyType="DWord"}
                        $MSDTCConfig1 +=
@{Path="$dtcpath\Security";Name='NetworkDtcAccessOutbound';Value=0x00000001;PropertyType="DWord"}
                        $MSDTCConfig1 +=
@{Path="$dtcpath\Security";Name='NetworkDtcAccessTip';Value=0x00000000;PropertyType="DWord"}
                        $MSDTCConfig1 +=
@{Path="$dtcpath\Security";Name='NetworkDtcAccessTransactions';Value=0x00000001;PropertyType="DWord"}
                        $MSDTCConfig1 +=
@{Path="$dtcpath\Security";Name='XaTransactions';Value=0x00000001;PropertyType="DWord"}


                        $MSDTCConfig1 | %{$_['Path'] } | select -Unique |
                                ForEach-Object {
                                        if (!(Get-Item -Path $_))
                                        {
                                                New-Item -Path $_
                                        }
                                }

                        $MSDTCConfig1 | % { (new-object PSObject -property $_) } |
                                ForEach-Object {
                                        if ($_ | Get-ItemProperty )
                                        {
                                                $_ | Set-ItemProperty
                                        }
                                        else
                                        {
                                                $_ | New-ItemProperty
                                        }
                                }

                }
                Write-ChildProgress -activity "Configuring MSDTC" -Status "Initializing" -PercentComplete 0  -
ParentId $ProgressParentID
```

```
        }
        process {
                $ComputerName | where {!([string]::IsNullOrWhiteSpace($_))} |
                        foreach-object {
                                $i++
                                $server = $_
                                Write-ChildProgress -activity "Configuring MSDTC" -Status "Installing on $Server"
-PercentComplete $i  -ParentId $ProgressParentID
                                Invoke-Command -ComputerName $server -ScriptBlock $setDTCSB
                        }
        }#process
        end {
                #no server list
                if ($i -eq 0)
                {
                        Invoke-Command -ScriptBlock $setDTCSB
                }
                Write-ChildProgress -Activity "Configuring MSDTC" -completed  -ParentId $ProgressParentID
        }
}


function Invoke-LNOSPreConfiguration
{
        <#
        .Synopsis
           Configures server(s) with pre-requisites for an LNOS installation.
        .DESCRIPTION
           Configures server(s) with pre-requisites for an LNOS installation.
                Enables multiple RDP sessions
                Configures MSDTC
                Grants logon as a service right
                Installs OS Components
        .EXAMPLE
           Invoke-LNOSPreConfiguration -ServiceAccount "Acme\serviceuser"

           Enables DTC settings required by LNOS on the local server.
```

```
        .EXAMPLE

                @("Server1","Server2","Server3","Server4") | Invoke-LNOSPreConfiguration -ServiceAccount
"Acme\serviceuser"

                Enables DTC settings required by LNOS on the provided remote servers.
        .OUTPUTS
           *NONE*
        .NOTES
          VERSION: 1.0
          COMMENT: INITIAL DRAFT
          AUTHOR: Jusitn Marshall
        #>
        Param(
                [Parameter(ValueFromPipeline=$true,Mandatory=$false,Position=1)]
                [Alias("CN")]
                [string[]]$ComputerName,
                [Parameter(Mandatory=$true)]
                [string]$ServiceAccount
        )
        begin {
                $i=0


                Write-Progress -activity "Pre-Configuring Servers for LNOS" -Status "Initializing" -
PercentComplete 0  -Id 0


        }
        process {
                $ComputerName | where {!([string]::IsNullOrWhiteSpace($_))} |
                        foreach-object {
                                $i++
                                $server = $_
                                Write-Progress -activity "Pre-Configuring Servers for LNOS" -Status "Installing
on $Server" -PercentComplete $i -Id 0
                                $_ | Install-LNOSOSRequirements -ProgressParentID 0
                                $_ | Install-LNOSMSDTCRequirements -ProgressParentID 0
```

```
                                $_ | Install-LNOSRDPMultipleSessions -ProgressParentID 0
                                Invoke-Command -ComputerName $_ `
                                        -Credential $cred -ScriptBlock (get-item function:Grant-
LogonAsAServiceRight).ScriptBlock `
                                        -ArgumentList $ServiceAccount
                        }
        }#process
        end {
                #no server list
                if ($i -eq 0)
                {
                        Install-LNOSOSRequirements -ProgressParentID 0
                        Install-LNOSMSDTCRequirements -ProgressParentID 0
                        Install-LNOSRDPMultipleSessions -ProgressParentID 0
                        Grant-LogonAsAServiceRight $ServiceAccount
                }
                Write-Progress -Activity "Pre-Configuring Servers for LNOS" -completed  -Id 0
        }
}
```

7.13.1.2 Using pre-Configuration Script

```
$ServerList = @("Server1","Server2")
$ServerList | Invoke-LNOSPreConfiguration
```

7.13.2 Legacy Cmd Scripts

7.13.2.1 Logon as a Service Right

In order for services to startup logon as a service right must be granted to the service admin account. This can be manually granted in several ways but it can be automated with this script.

This requires downloading the ntrights utility:

http://www.microsoft.com/en-us/download/details.aspx?id=17657

ServiceAccountConfig.cmd

```
set ServiceAccount=%1


net localgroup Administrators "%ServiceAccount%" /add
ntrights -u "%ServiceAccount%" +r "SeServiceLogonRight"
```

7.13.2.2 MSDTC Configuration

Prior to installation the MSDTC needs to be configured per the earlier appendix. This can be automated by importing the following registry file.

MSDTC Config for LNOS.reg

```
Windows Registry Editor Version 5.00


[HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\MSDTC]
"AllowOnlySecureRpcCalls"=dword:00000000
"FallbackToUnsecureRPCIfNecessary"=dword:00000000
"MaxLogSize"=dword:00000200
"TurnOffRpcSecurity"=dword:00000001



[HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\MSDTC\Security]
"DomainControllerState"=dword:00000000
"LuTransactions"=dword:00000001
"NetworkDtcAccess"=dword:00000001
"NetworkDtcAccessAdmin"=dword:00000001
"NetworkDtcAccessClients"=dword:00000001
"NetworkDtcAccessInbound"=dword:00000001
"NetworkDtcAccessOutbound"=dword:00000001
"NetworkDtcAccessTip"=dword:00000000
"NetworkDtcAccessTransactions"=dword:00000001
"XaTransactions"=dword:00000001
```

7.13.2.3 Fix Parent Paths and Generated Files

Periodically after install the IIS Parent Paths are not correctly configured, in addition sometimes the permissions of the \inetpub\wwwroot\[appui]\generatedfiles folder are not correctly set by the installer, the following script will automatically fix both of these issues, it dynamically determines the list of folders it just needs the root directory of the WWW service.

FixParentPathsAndGeneratedFiles.cmd

```
@echo off
```

```
AT > NUL
IF %ERRORLEVEL% EQU 0 (
   ECHO you are Administrator
) ELSE (
   ECHO you are NOT Administrator. Exiting...
   PING 127.0.0.1 > NUL 2>&1
   EXIT /B 1
)


for /d %%a in (c:\inetpub\wwwroot\*) do (
@Echo ************************************
@Echo enabling parent paths for %%a
@Echo ************************************
call :EnableParentPath %%a
@Echo ************************************
@Echo Configuring permissions for generated files for %%a
@Echo ************************************
IF EXIST "%%a\GeneratedFiles" icacls "%%a\GeneratedFiles" /grant IUSR:^(OI^)^(CI^)F
IIS_IUSRS:^(OI^)^(CI^)F
@Echo ########################################
)

pause
:EnableParentPath
FOR /F "delims=|" %%B IN ("%1") do %windir%\system32\inetsrv\appcmd.exe set config "Default Web
Site/%%~nxB" /section:asp /enableParentPaths:true /commit:apphost
goto:eof


pause
```

7.13.2.4 IIS Tracing Setup

The following script can be used to enable IIS tracing for troubleshooting failures and timeout conditions. The script below will enable tracing on a 500 error OR a request taking more than 28 seconds.

IISTracingSetup.cmd

```
REM Enable Tracing

START /WAIT DISM /Online /Enable-Feature /FeatureName:IIS-HttpTracing


REM Prepare Trace Folder

SET TracePath=E:\Logs\FailedReqLogFiles

MD %TracePath%


REM Enable and configure tracing

CD %systemroot%\system32\inetsrv\

appcmd.exe set config /section:sites -siteDefaults.traceFailedRequestsLogging.maxLogFileSizeKB:102400

appcmd.exe set config /section:system.applicationHost/sites "/[name='Default Web Site'].traceFailedRequestsLogging.enabled:true" /commit:apphost

appcmd.exe set config /section:system.applicationHost/sites "/[name='Default Web Site'].traceFailedRequestsLogging.directory:%TracePath%" /commit:apphost

appcmd.exe set config /section:system.applicationHost/sites "/[name='Default Web Site'].traceFailedRequestsLogging.maxLogFiles:30" /commit:apphost

appcmd.exe set config "Default Web Site/" /section:system.webServer/tracing/traceFailedRequests /+"[path='*.asp']"

appcmd.exe set config "Default Web Site/" /section:system.webServer/tracing/traceFailedRequests /+"[path='*.asp'].traceAreas.[provider='ASP',areas='',verbosity='Verbose']"

appcmd.exe set config "Default Web Site/" /section:system.webServer/tracing/traceFailedRequests /+"[path='*.asp'].traceAreas.[provider='ASPNET',areas='Infrastructure,Module,Page,AppServices',verbosity='Verbose']"

appcmd.exe set config "Default Web Site/" /section:system.webServer/tracing/traceFailedRequests /+"[path='*.asp'].traceAreas.[provider='ISAPI Extension',areas='',verbosity='Verbose']"

appcmd.exe set config "Default Web Site/" /section:system.webServer/tracing/traceFailedRequests /+"[path='*.asp'].traceAreas.[provider='WWW Server',areas='Authentication,Security,Filter,StaticFile,CGI,Compression,Cache,RequestNotifications,Module,FastCGI',verbosity='Verbose']"

appcmd.exe set config "Default Web Site/" /section:system.webServer/tracing/traceFailedRequests /"[path='*.asp'].failureDefinitions.statusCodes:"500"
```

appcmd.exe set config "Default Web Site/" /section:system.webServer/tracing/traceFailedRequests /"[path='*.asp'].failureDefinitions.timeTaken:"00:00:28"

7.13.2.5 All-In-One script

The all in one script does all server setup require to run Descartes Route Planner and other LNOS-based applications. It installs the IIS required components, enables tracing if requests, etc. The user is prompted through each step of the install but these prompts can be bypassed by passing command line arguments.

LNOS Prod Server Config – UI and BIF.cmd

@REM example script to prep a server for UI or BIF (Listener) processing

@REM change service account to use, create one script for each environment worked with

call "%~dp0\lnos server AllInOne Config.cmd" acme\serviceuser Y Y

call "%~dp0\LNOS Server RP Recycling.cmd"

LNOS Prod Server Config – BGO,DFL,BE-Asynch.cmd

@REM example script to prep a server for BGO, DFL or BE/Asynch processing

@REM change service account to use, create one script for each environment worked with

call "%~dp0\lnos server AllInOne Config.cmd" acme\serviceuser Y N

call "%~dp0\LNOS Server RP Recycling.cmd"

LNOS Server AllInOneConfig.cmd

```
@echo off
AT > NUL
IF %ERRORLEVEL% EQU 0 (
   ECHO you are Administrator
) ELSE (
   ECHO you are NOT Administrator. Exiting...
   PING 127.0.0.1 > NUL 2>&1
   EXIT /B 1
)
cls
@echo *** Configuration script to setup server for LNOS installation ***
REM ############################################################
REM ############ ENVIRONMENT VARIABLES ##########################
```

```
REM ############################################################
set "DefServiceAccount="
set DefServiceAccount=%1
set DoInstall=%2
set DoTracing=%3
SET DefTracePath=E:\Logs\FailedReqLogFiles
Set DefTraceLogFiles=30
SET DefTraceLogFileSize=102400
SET DefTraceTimeLimit=00:00:28
SET DefTraceStatusCodes=500


if A%1==A goto :InputAcct
:skipsvc
set ServiceAccount=%DefServiceAccount%
echo using ServiceAccount %DefServiceAccount%
goto :DoInput


:inputAcct
set /p UsrServiceAccount=Provide Service Account (e.g. descartes\fwpresystem):
if A%UsrServiceAccount%==A goto :inputAcct
set ServiceAccount=%UsrServiceAccount%


:DoInput

if [%2]==[] goto inputParms
set DoComponents=%2
echo Installing Components?
goto skipinput1
:inputParms
```

```
CHOICE /M "Should windows components be Installed "
IF ErrorLevel 2 set DoComponents=N
IF ErrorLevel 1 set DoComponents=Y
:skipinput1
echo You Picked: %DoComponents%

if [%3]==[] goto inputParms2
set DoTrace=%3
echo Do IIS Tracing?
goto skipinput2
:inputParms2
CHOICE /M "Should IIS tracing be enabled "
IF ErrorLevel 2 set DoTrace=N
IF ErrorLevel 1 set DoTrace=Y
:skipinput2
echo You Picked: %DoTrace%

if [%3]==[] goto DoTraceParm
set UsrTracePath=
set UsrTraceLogFiles=
set UsrTraceLogFileSize=
set UsrTraceTimeLimit=
set UsrTraceStatusCodes=
goto SkipTraceParm
:DoTraceParm
if %DoTrace%==N goto :skipTraceParm
set /p UsrTracePath=Provide IIS Trace Path (Def: %DefTracePath%)
set /p UsrTraceLogFiles=Provide IIS Trace Log Files to Keep (Def: %DefTraceLogFiles%)
set /p UsrTraceLogFileSize=Provide IIS Trace File Size (Def: %DefTraceLogFileSize%)
set /p UsrTraceTimeLimit=Provide IIS Trace Time Limit (Def: %DefTraceTimeLimit%)
set /p UsrTraceStatusCodes=Provide IIS Trace Status Codes (Def: %DefTraceStatusCodes%)
:skipTraceParm
```

```
if A%UsrTracePath%==A goto :DefPath
set TracePath=%UsrTracePath%
goto :skipPath
:DefPath
set TracePath=%DefTracePath%
:skipPath

if A%UsrTraceLogFiles%==A goto :DefLogFiles
set TraceLogFiles=%UsrTraceLogFiles%
goto :skipLogFiles
:DefLogFiles
set TraceLogFiles=%DefTraceLogFiles%
:skipLogFiles

if A%UsrTraceLogFileSize%==A goto :DefLogFileSize
set TraceLogFileSize=%UsrTraceLogFileSize%
goto :skipLogFileSize
:DefLogFileSize
set TraceLogFileSize=%DefTraceLogFileSize%
:skipLogFileSize

if A%UsrTraceTimeLimit%==A goto :DefTimeLimit
set TraceTimeLimit=%UsrTraceTimeLimit%
goto :skipTimeLimit
:DefTimeLimit
set TraceTimeLimit=%DefTraceTimeLimit%
:skipTimeLimit

if A%UsrTraceStatusCodes%==A goto :DefStatusCode
set TraceStatusCodes=%UsrTraceStatusCodes%
```

```
goto :skipStatusCode
:DefStatusCode
set TraceStatusCodes=%DefTraceStatusCodes%
:skipStatusCode

REM uncomment to test input parameters only
REM goto :END

REM ************************************************************

REM ################################################################
REM ############ Establish service account ######################
REM ################################################################
net localgroup Administrators "%ServiceAccount%" /add
"%~dp0\ntrights" -u "%ServiceAccount%" +r "SeServiceLogonRight"
REM ************************************************************


if "%DoComponents%"=="Y" goto :installcomponent
if "%DoComponents%"=="N" goto :skipcomponent
:installcomponent
REM ################################################################
REM ############ Install and configure IIS ######################
REM ################################################################
REM /FeatureName:IIS-CustomLogging???
START /WAIT DISM /Online /Enable-Feature /FeatureName:IIS-ApplicationDevelopment /FeatureName:IIS-ASP
/FeatureName:IIS-ASPNET /FeatureName:IIS-BasicAuthentication /FeatureName:IIS-CommonHttpFeatures
/FeatureName:IIS-DefaultDocument /FeatureName:IIS-DirectoryBrowsing /FeatureName:IIS-HealthAndDiagnostics
/FeatureName:IIS-HttpCompressionDynamic /FeatureName:IIS-HttpCompressionStatic /FeatureName:IIS-HttpErrors
/FeatureName:IIS-HttpLogging /FeatureName:IIS-HttpRedirect /FeatureName:IIS-HttpTracing /FeatureName:IIS-
IIS6ManagementCompatibility /FeatureName:IIS-ISAPIExtensions /FeatureName:IIS-ISAPIFilter /FeatureName:IIS-
LegacyScripts /FeatureName:IIS-LegacySnapIn /FeatureName:IIS-LoggingLibraries /FeatureName:IIS-ManagementConsole
/FeatureName:IIS-ManagementScriptingTools /FeatureName:IIS-ManagementService /FeatureName:IIS-Metabase
/FeatureName:IIS-NetFxExtensibility /FeatureName:IIS-ODBCLogging /FeatureName:IIS-Performance /FeatureName:IIS-
RequestFiltering /FeatureName:IIS-RequestMonitor /FeatureName:IIS-Security /FeatureName:IIS-ServerSideIncludes
/FeatureName:IIS-StaticContent /FeatureName:IIS-WebServer /FeatureName:IIS-WebServerManagementTools
```

```
/FeatureName:IIS-WebServerRole /FeatureName:IIS-WindowsAuthentication /FeatureName:IIS-WMICompatibility
/FeatureName:WAS-ConfigurationAPI /FeatureName:WAS-NetFxEnvironment /FeatureName:WAS-ProcessModel
/FeatureName:WAS-WindowsActivationService
REM ************************************************************


REM ################################################################
REM ############ Install and configure MSMQ ####################
REM ################################################################
START /WAIT DISM /Online /Enable-Feature /FeatureName:MSMQ-Server
REM ************************************************************


REM ################################################################
REM ############ Enable Tracing #################################
REM ################################################################
START /WAIT DISM /Online /Enable-Feature /FeatureName:IIS-HttpTracing
REM ************************************************************

:skipcomponent

REM ################################################################
REM ############ Prepare Trace Folder ###########################
REM ################################################################
MD %TracePath%
REM ************************************************************


REM ################################################################
REM ############ Enable and configure tracing ###################
REM ################################################################
if %DoTrace%==N goto :skipTraceParm2
CD %systemroot%\system32\inetsrv\
```

```
%windir%\System32\inetsrv\appcmd.exe set config /section:sites -
siteDefaults.traceFailedRequestsLogging.maxLogFileSizeKB:%TraceLogFileSize%

%windir%\System32\inetsrv\appcmd.exe set config /section:system.applicationHost/sites "/[name='Default Web
Site'].traceFailedRequestsLogging.enabled:true" /commit:apphost

%windir%\System32\inetsrv\appcmd.exe set config /section:system.applicationHost/sites "/[name='Default Web
Site'].traceFailedRequestsLogging.directory:%TracePath%" /commit:apphost

%windir%\System32\inetsrv\appcmd.exe set config /section:system.applicationHost/sites "/[name='Default Web
Site'].traceFailedRequestsLogging.maxLogFiles:%TraceLogFiles%" /commit:apphost

%windir%\System32\inetsrv\appcmd.exe set config "Default Web Site/"
/section:system.webServer/tracing/traceFailedRequests /+"[path='*.asp']"

%windir%\System32\inetsrv\appcmd.exe set config "Default Web Site/"
/section:system.webServer/tracing/traceFailedRequests
/+"[path='*.asp'].traceAreas.[provider='ASP',areas='',verbosity='Verbose']"

%windir%\System32\inetsrv\appcmd.exe set config "Default Web Site/"
/section:system.webServer/tracing/traceFailedRequests
/+"[path='*.asp'].traceAreas.[provider='ASPNET',areas='Infrastructure,Module,Page,AppServices',verbosity='Verbose']"

%windir%\System32\inetsrv\appcmd.exe set config "Default Web Site/"
/section:system.webServer/tracing/traceFailedRequests /+"[path='*.asp'].traceAreas.[provider='ISAPI
Extension',areas='',verbosity='Verbose']"

%windir%\System32\inetsrv\appcmd.exe set config "Default Web Site/"
/section:system.webServer/tracing/traceFailedRequests /+"[path='*.asp'].traceAreas.[provider='WWW
Server',areas='Authentication,Security,Filter,StaticFile,CGI,Compression,Cache,RequestNotifications,Module,FastCGI',verbos
ity='Verbose']"

%windir%\System32\inetsrv\appcmd.exe set config "Default Web Site/"
/section:system.webServer/tracing/traceFailedRequests /"[path='*.asp'].failureDefinitions.statusCodes:"500"

%windir%\System32\inetsrv\appcmd.exe set config "Default Web Site/"
/section:system.webServer/tracing/traceFailedRequests /"[path='*.asp'].failureDefinitions.timeTaken:"%TraceTimeLimit%"

:skipTraceParm2

REM ************************************************************


REM ############################################################

REM ############ Configure MSDTC Security Settings #############

REM ############################################################

call "%~dp0\ConfigureMSDTC.cmd

REM ************************************************************


:END

@echo *** LNOS script finished ***
```

pause

7.14 Monitoring Script Samples

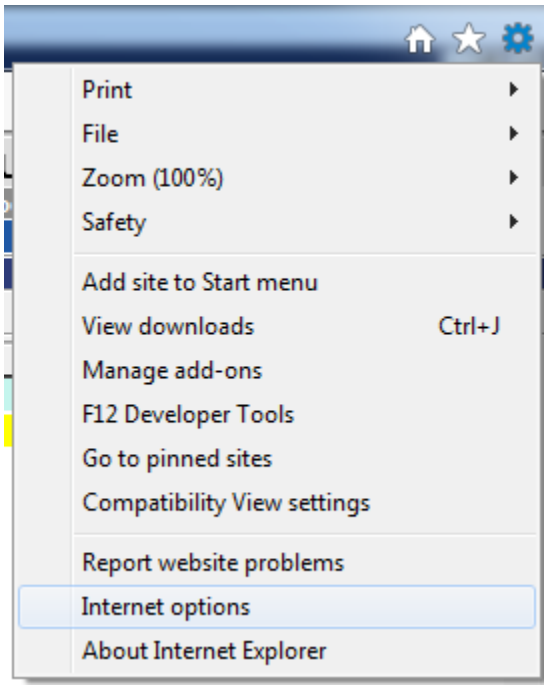
Application Pool

MSMQ Queue

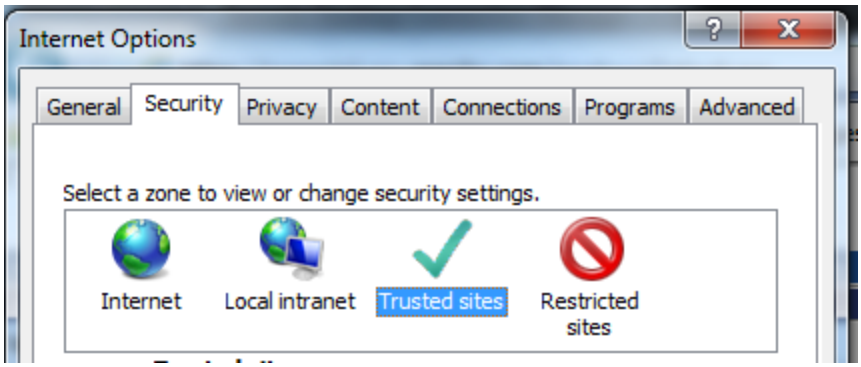
7.15 Configure Internet Explorer for use with Descartes Route Planner

7.15.1 Setup trusted sites

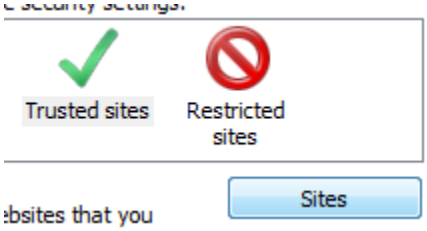
- Due to security restrictions in the browser, the application must be setup as a trusted site otherwise certain features and functions will not operate as designed.
  - The steps to do this on Internet Explorer® 10/11 are as follows, earlier versions are not supported.
  - Click the **"wrench"** icon and go to **Internet Options**



  - Go to the **Security** tab, and select **Trusted Sites** from the zone list



- Click the **Sites** button



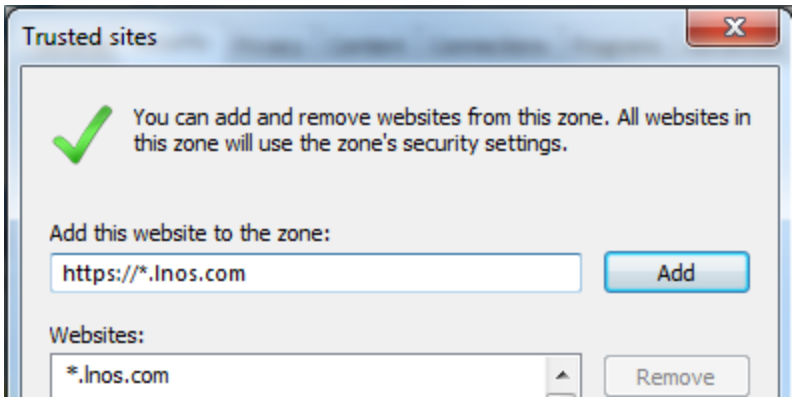
- Type in https://*.lnos.com and click **Add**
- Type in https://*.gln.com and click **Add**

➲ **Note—** If not hosted by Descartes these URLs should be updated to match your internal Descartes Route Planner and Descartes AltaMap Map URLs.

- If using google:
  - Type in http://*.googleapis.com and click **Add**
  - Type in http://maps.google.com and click **Add**
  - Type in http://maps.gstatic.com and click **Add**

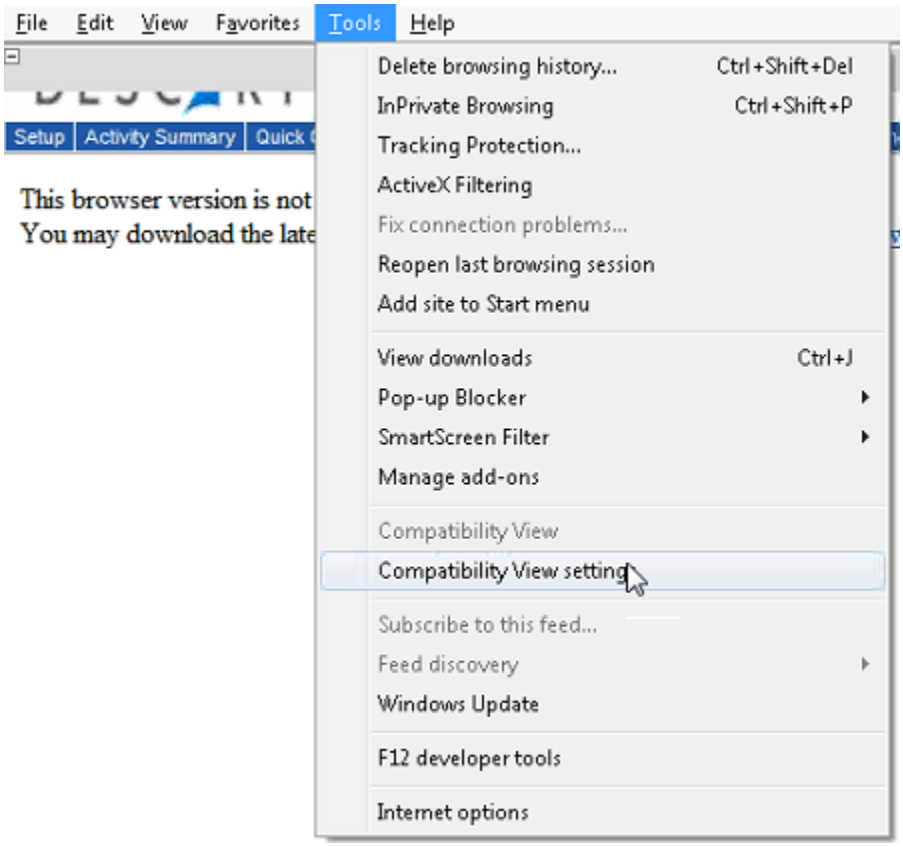
➲ **Note—** this is required on the server's browser as well to display the maps under Internet Explorer® enhanced security configuration.

- Once added these should show up in the list below.

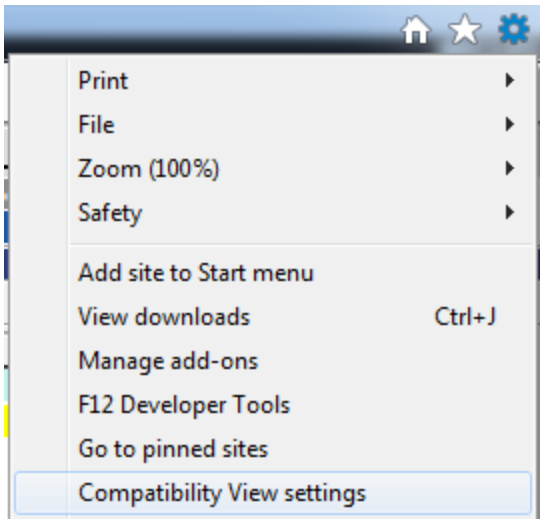

Trusted sites
You can add and remove websites from this zone. All websites in this zone will use the zone's security settings.
Add this website to the zone:
https://*.lnos.com
Add
Websites:
*.lnos.com
Remove

7.15.2 Setup compatibility mode

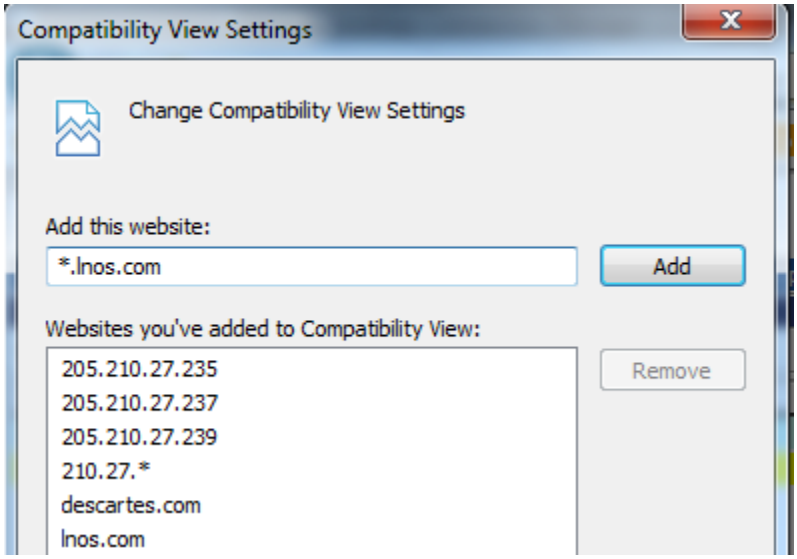
- Due to the way the application currently works, the applications must run in compatibility mode otherwise certain features and functions will not operate as designed.
  - The menu is accessed differently in Internet Explorer® 10 and Internet Explorer® 11 but the remainder of the steps are the same.
  - Internet Explorer® 10 opening compatibility view settings
    - Press **Alt** key as the menu is hidden
    - Go to **Tools** menu then **Compatibility View Settings**



  - Internet Explorer® 11 opening compatibility view settings
    - Click the "wrench" icon and go to Compatibility View Settings



- Common Steps:
  - Type in *.lnos.com and click **Add**
  - **Note:** If not hosted by Descartes these url's should be updated to match your internal Descartes Route Planner and Descartes AltaMap Map url's.
  - Once added it should show up in the list below.



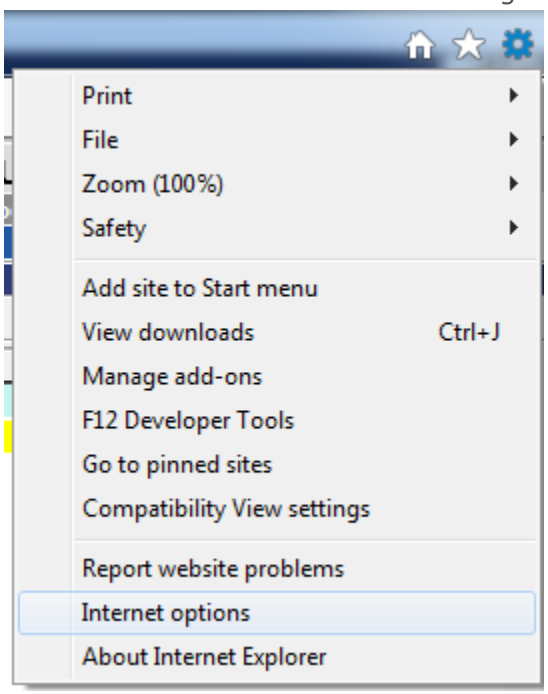
➲ **Note—** If not hosted by Descartes these url's should be updated to match your internal Descartes Route Planner and Descartes AltaMap Map url's.

7.15.3 Disable "Enable HTTP Friend Error Messages"

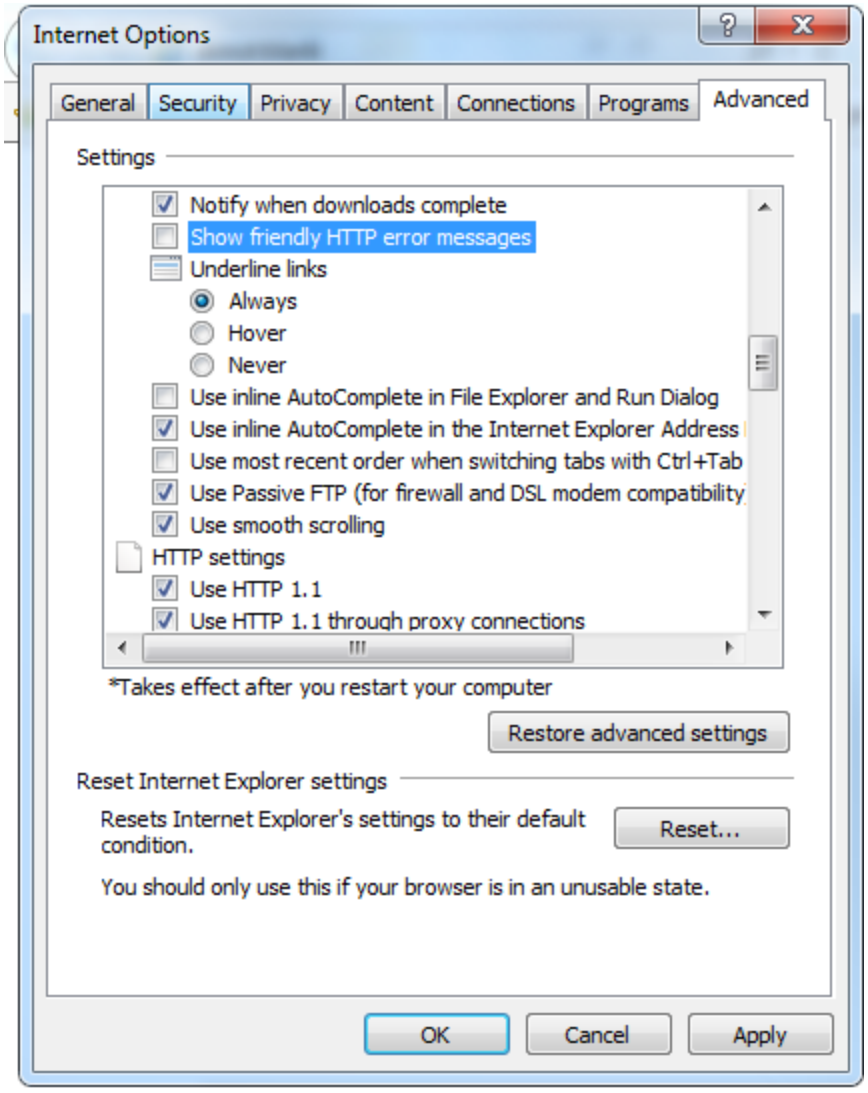
- Enable HTTP Friendly error messages obscures the application error and returns a generic error page which complicates investigations, in addition certain errors will

redirect the user to their homepage after a brief white screen rather than displaying the error encountered which causes user confusion.

- The steps to do this on Internet Explorer® 10/11 are as follows, earlier versions are not supported.
- Click the **"wrench"** icon and go to **Internet Options**

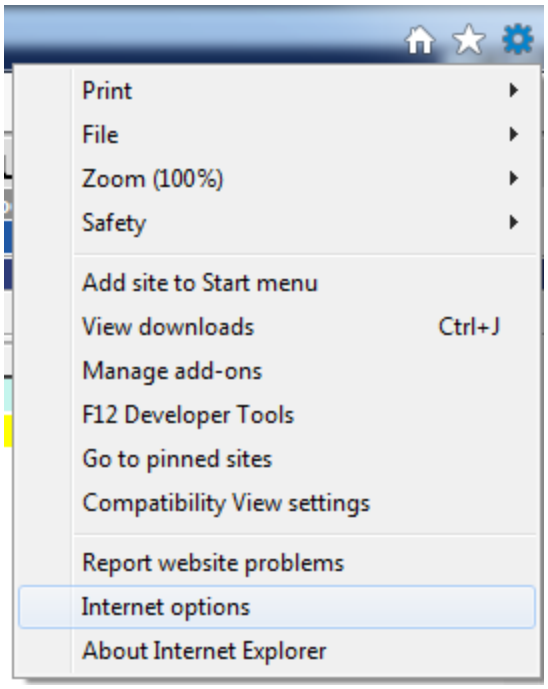


- Switch to the **Advanced** tab
- Scroll down and uncheck Show Friendly HTTP Error Messages
- Click OK or Apply when finished.

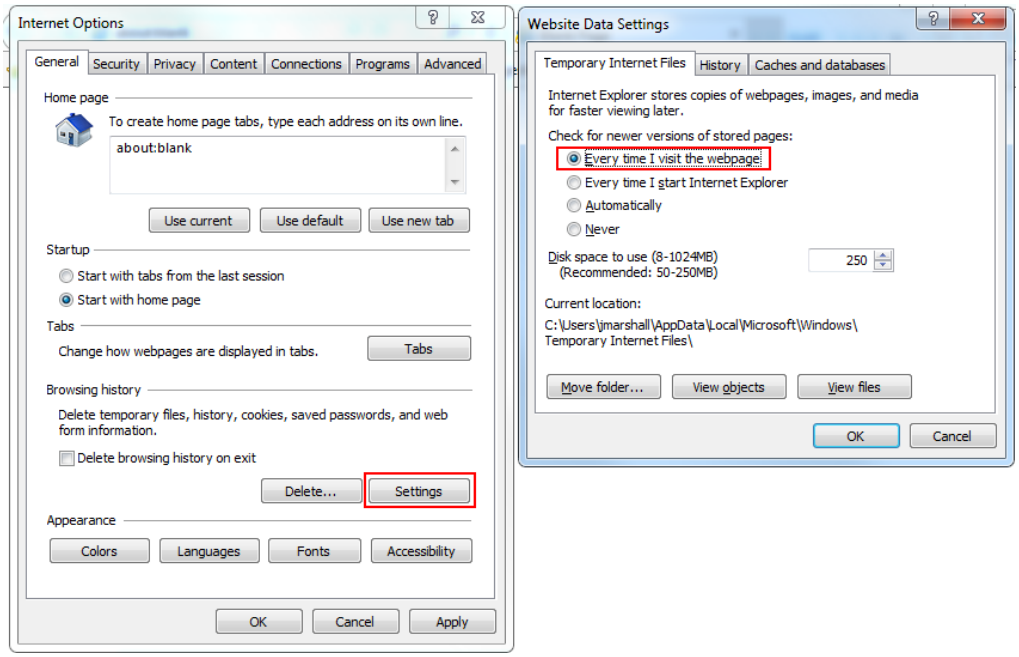


7.15.4 Enable "Refresh Every Visit to this WebPage"

- Descartes Route Planner caches certain client-side files locally, these files do not always refresh correctly. To avoid this problem it is recommended that the client be configured to check with the server on every request ensure it always has the latest version. This can result in pages not load or odd behavior like preferences not taking effect immediately (e.g. tree page size). Problems are also more likely to result after upgrades if these steps are not taken.
  - The steps to do this on Internet Explorer® 10/11 are as follows, earlier versions are not supported.
  - Click the **"wrench"** icon and go to **Internet Options**



- In the **General** tab
  - Click **Settings** button under **Browser Settings** section
  - Click the radio button beside **Configure with Every Time I Visit the Webpage**. The Default is *Automatically*.



7.16 RMWS and Power Management

RMWS is very sensitive to any delays in CPU or memory allocation. Incorrectly configured power management settings can slow down matrix calculations by as much as 30 percent.

- Windows® OS Power management plan should be configured as High Performance.
- BIOS System Profile / Power should also be configured as Performance or High Performance. Please note: this is not the same setting as Performance Per Watt.

8 Document Management

8.1 Document Control Table

Version	Date	Author	Comment
1.0	11/10/2011	Justin Marshall	Initial Draft
1.3	12/13/2011	Justin Marshall	Added network requirements
1.4	02/06/2012	Justin Marshall	Updated Installation requirements and added windows 7/2008 MSDTC configuration steps to appendix.
1.5	02/15/2012	Justin Marshall	Added windows 2003 MSDTC Configurations teps to appendix.
1.6	04/09/2012	Justin Marshall	Moved database health tasks to section 5. Corrected installation requirements for Win2k8
1.7	04/18/2012	Justin Marshall	Added Proxy details to Network stability section Changed F5 section to Hardware Load Balancer, added F5 configuration to appendix. Added Database Blocking Script Added old lock cleanup process Added IIS post-install tasks
1.8	07/23/2012	Justin Marshall	Added additional notes regarding Network Stability.
1.10	10/17/2012	Justin Marshall	Added FWBatchProcessor to monitoring list Added SNAT settings to F5 config guide
1.12	01/21/2013	Justin Marshall	Corrects to F5 Config Guide Additional SQL Requirements Corrections to Queue MOnitoring ESX Performance Counters
1.13	04/09/2013	Justin Marshall	Further corrections to the F5 config guide
1.14	04/11/2013	Justin Marshall	Added logon as a service & .NET verification to appendix
1.15	05/10/2013	Justin Marshall	Added 2008 R2 as a supported OS.
1.16	05/15/2013	Achim Brökelmann	Transferred to new template, Fleetwise replaced by Descartes Route Planner
1.17	06/11/2013	Justin Marshall	AntiVirus exclusions
1.18	06/26/2013	Justin Marshall	Added BIF (Reservations) monitoring requirements. Updated F5 config for LoginPage monitor.
1.19	07/15/2013	Justin Marshall	Added MSDTC firewall exclusions
1.20	09/30/2013	Justin Marshall	Added SQL service account requirements. Antivirus agent port issues.
1.21	10/11/2013	Justin Marshall	Added SQL performance counters Put Database Blocking process code as part of the appendix

			Put FW & Security cleanup stored procs as part of the appendix.
1.22	12/13/2013	Justin Marshall	Added note about lock cleanup query Removed network estimate for specific environment Cleaned up some old pathing software references to indicate 11.x and lower only.
1.23	01/17/2014	Justin Marshall	Added Active Directory domain requirements.
1.24	02/12/2014	Justin Marshall	Updated cleanup stored procs and related references
1.25	02/21/2014	Justin Marshall	Minor corrections.
1.26	03/07/2014	Justin Marshall	Correction to the Sec Cleanup stored procedure, incorrectly referenced non-existent createddate column.
1.28	04/04/2014	Justin Marshall	Added URL Rewrite 2.0 install requirements for 13.2.3 and higher.
1.29	04/28/2014	Justin Marshall	Rewrote virtualization section adding additional requirements. Added Descartes AltaMap benchmark to appendix. Added SQL tuning configuration steps.
1.30	05/14/2014	Justin Marshall	
1.31	05/21/2014	Justin Marshall	Added Firewall & MSDTC details to installation requirements
1.32	05/29/2014	Justin Marshall	Added SessionServer database backup/recovery model Added Disk & tempdb recommendations
1.33	06/30/2014	Justin Marshall	Correct typo on F5 monitors
1.34	07/31/2014	Justin Marshall	Update intended audience.
1.35	10/16/2014	Justin Marshall	Updated F5 config guide Merged in NLB (2003) guide Added KVM virtualization details for Descartes AltaMap Updated VMWare virtualization details for Descartes AltaMap
1.36	10/20/2014	Justin Marshall	Added server setup scripts
1.37	11/21/2014	Justin Marshall	Updated cleanupsec script
1.38	12/03/2014	Kjartan Ouwerkerk	Template update
1.39	01/20/2015	Chris Herbert	Added 2012 R2 as a supported OS.
1.40	01/30/2015	Justin Marshall	Added Batch Processor table queue
1.41	02/02/2015	Justin Marshall	Corrected CPU perf counter Added recommendations around batch processor queue monitoring frequency.
1.42	02/11/2015	Justin Marshall	Re-merged F5 config guide and added screenshots. Added additional details about unique CID for MSDTC & Cloning (VM)
1.43	02/15/2015	Justin Marshall	Added table with memory threshold recommendations for TestDCFServices

1.44	02/18/2015	Justin Marshall	Added F5 security recommendations for SSL vulnerabilities
1.45	02/27/2015	Justin Marshall	Added additional SQL performance counters
1.46	03/12/2015	Justin marshall	Added client-side Internet Explorer® configuration requirements
1.48	05/04/2015	Justin Marshall	Updated SQL Server® requirements
1.49	07/31/2015	Justin Marshall	Added trusted sites requirement for google maps Updated F5 config guide monitor timeout.
1.50	08/12/2015	Justin Marshall	Added node flapping troubleshooting scenario for duplicate self-ip.
1.51	09/02/2015	Justin Marshall	Updated RestartCOM memory thresholds for UI, BIF & BGO separately.
1.52	10/20/2015	Justin Marshall	Removed references to old pathing technology, added powershell scripts for server preparation (Pre-Config). Clarified Descartes AltaMap requirements, added sizing estimate matrix.
1.53	10/30/2015	Justin Marshall	Added note about EDGE browser
1.54	06/10/2016	Justin Marshall	Added requirements regarding power management for LPS/RMWS.