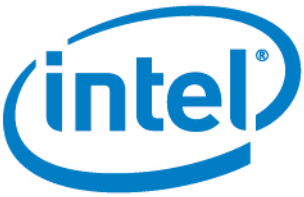

Intel® Setup and Configuration Software (Intel® SCS)

Scalability Guidelines

Version 10.0

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1 Introduction

This document contains guidelines to help you plan a large scale deployment of Intel® Active Management Technology (Intel® AMT) using Intel® Setup and Configuration Software (Intel® SCS). Although the document is intended mainly for organizations that want to deploy tens of thousands of systems, it contains information that can also be helpful for smaller deployments.

Intel SCS has been successfully deployed and used by several organizations that have more than 100,000 Intel AMT systems. Much of the knowledge and experience gained during these large scale deployments has been gathered and included in this document. In addition, during development of Intel SCS 10 we also setup and ran a series of "scalability tests". Intel SCS 10.0 includes fixes and improvements to several issues that we identified during the scalability tests.

This remainder of this document is divided into four sections.

Section	Details
Environment Variables	This section contains a checklist of questions that you need to answer about your environment. The checklist also contains important information that you need to take into consideration.
Scalability Example Data	This section contains the data we collected from our scalability tests. You can refer to this data for an indication of what to expect when configuring large amounts of systems.
Scalability Factors	This section contains additional information that will help you to understand issues that are important when dealing with a large scale deployment.
References	This section contains short descriptions about the terms used in this document, and references to where you can find more information in the documentation of Intel SCS.

Assumptions

Intel SCS includes many different components and options. The information included in this document assumes that you will:

- Install and use at least one instance of the Remote Configuration Service (RCS)
- Only use configuration/maintenance commands that are performed by the RCS. Specifically:
  - The `ConfigViaRCSOnly` command
  - The `MaintainViaRCSOnly` command
  - Jobs (available in the Console when the RCS is installed in database mode)

These assumptions are based on the fact that most organizations want to configure Intel AMT in Admin Control Mode. Configuring Admin Control Mode can only be done by the RCS. The guidelines in this document are intended to prevent the RCS from becoming a "central point of failure" when dealing with requests from thousands of systems. If the restrictions of Client Control mode are not a problem for your current requirements, then you can use the host-based configuration option of Intel SCS instead. The host-based configuration option does not require or use an RCS (so most the guidelines in this document are not relevant).

2 Environment Variables

The environment and requirements of every organization are different. But when planning a large deployment, there are some basic questions that you need to answer before you start to implement anything. Use the information and the questions in this table and apply it to your organization.

Environment Variables Checklist	
1	**How many Intel AMT systems does your organization have?** This is the first and most basic question for which you need an answer. This is because the number of Intel AMT systems will directly impact many of the other items described in this table. For example, it takes more time to configure 100,000 systems than it does to configure 10,000 systems.
2	**What is the window of availability for the configuration of Intel AMT?** Configuration of a large number of Intel AMT systems can take some time and can use several different types of network resources. Tasks that require the use of network resources are usually allocated specific periods or "windows" of availability during which they can use these network resources. The number and duration of these windows of availability in your organization is the first constraint that you need to take into consideration. To help you answer this question, these are the two parameters that you need to determine: 1. How many hours per week can you allocate to configuration of Intel AMT? 2. In how many weeks do you want to complete the configuration cycle? **Note:** • You can configure Intel AMT even when the system is being used by the user. But, if you prefer to configure when the system is not in use, take this into consideration when determining the number of hours available. For example, are you restricted to overnight, or only weekends? • After initial configuration, you will only need to reconfigure the systems if you want to make changes to the settings in Intel AMT.
3	**What is the window of availability for scheduled maintenance of Intel AMT?** After a system is configured, it is necessary to maintain and periodically update the configuration settings in the Intel AMT device. If you do not, your management console might lose connection with the Intel AMT device. Intel SCS includes methods to perform these maintenance tasks on Intel AMT. For descriptions of these tasks, see Maintenance Data Results on page 12. Maintenance tasks usually take less time and less network resources than configuration. But because maintenance tasks must be done regularly, you need to plan for your maintenance schedule. To help you answer this question, these are the parameters that you need to determine: 1. How many hours per week can you allocate to maintenance tasks of Intel AMT? 2. Based on your IT policies, what is the required maintenance cycle time for each task? For example, how often do you renew AD passwords or reissue certificates? 3. In how many weeks do you want to complete a full maintenance cycle? **Note:** Just like configuration, you can run maintenance tasks even when the system is being used by the user.

Environment Variables Checklist	
4	**How do you deploy the configuration/maintenance commands?** Most of the methods used to configure/maintain Intel AMT are initiated using the Configurator component running on the host platform. The method that you use to deploy the Configurator and run these commands on tens of thousands of systems needs to be taken into consideration. This is important because sending configuration/maintenance commands to tens of thousands of Intel AMT systems simultaneously will almost certainly cause multiple failures and network overload. For example, task sequences of Microsoft* System Center Configuration Manager are sent out almost simultaneously (within approximately 15 minutes) to all target systems. Therefore, it is recommended to spread out the deployment time by targeting the task sequences on smaller collections, or using batch files with randomized delays. Whichever deployment method or management console you use, the goal is to avoid sending out mass configuration/maintenance commands to all your systems at the same time. Use the data that you collected in items #1, #2, and #3 to help you determine the best allocation and distribution of configuration and maintenance commands. **Note:** • The `/RCSBusyRetryCount` parameter can also help to automatically spread out the load on the RCS when it is busy (see RCSBusyRetryCount Parameter on page 18). • If you install the RCS in database mode (see item #6), you can use the Console to run reconfiguration and maintenance commands via the RCS using "jobs". A job is an operation that you can run from the Console on a selected group of Intel AMT systems, defined using a filter. When a job starts, the RCS starts the operation simultaneously on the first 50 systems defined in the job. After 30 seconds, the RCS starts the operation on another set of systems (up to the maximum of 50 systems in parallel). This cycle continues until the operation is run on all systems in the job. Because the RCS automatically controls the number of simultaneous operations, this means that the possibility of network overload and failures is reduced.
5	**Will you need more than one certificate per Intel AMT system?** This variable is relevant only if you intend to configure any of these settings in Intel AMT: • Transport Layer Security (TLS) • Remote Access (to enable connection via a Management Presence Server) • 802.1x Setups (for wired and/or wireless profiles) • End-Point Access Control (EAC) All of the settings listed above require a certificate to be configured in Intel AMT. If you intend to configure more than one of these settings, will you be using the same certificate for each setting? Or do you intend to use a different certificate for each setting? Configuring a certificate in Intel AMT takes time. And, logically, configuring multiple certificates in each system will increase the time it takes for configuration. **Note:** Although there are four settings, you can only configure a maximum of three different certificates in Intel AMT (but you can use the same certificate for different settings.)

Environment Variables Checklist	
6	**Do you intend to install the RCS in database mode or non-database mode?** The RCS can operate in one of two different modes (defined during installation): • Non-Database Mode – In this mode, the RCS does not store any data about Intel AMT systems • Database Mode – In this mode, data about each Intel AMT system is stored in an SQL database. This includes data that can be used to connect to the system and the admin password that was configured in the Intel AMT device. These different modes do not have any impact on the time that it takes the RCS to configure or maintain Intel AMT. But there are differences between the two modes that you should take into consideration. In both modes, the RCS keeps a log file that records all actions done by the RCS. The main purpose of this log file is for debugging problems with the RCS. It is not easy to use this log file to investigate the success or failure of configuration/maintenance commands on the systems. In non-database mode, no other data is available to help you with debugging. Analysis or investigation of the return status codes from configuration/maintenance commands must be done on the host platforms. But in database mode, the RCS stores an operations log in the database for each system. You can use the Console component of Intel SCS to view these operations logs per system. In database mode, the admin password configured in Intel AMT is stored in the database for each system. This means that the password configured for each system is always accessible (you can use the Console to view the admin password of each system). Having access to this password is even more important if you are using the option to create a random admin password for each system. (If the passwords are not stored in the database, they will be unknown to you or any application.) Using database mode will increase the traffic to your SQL Server. But database mode also includes several other options that can help you to monitor and maintain your systems. For example, you can use the Console to define and run maintenance "Jobs" on multiple systems and view discovery data collected from your systems.
7	**Do you intend to "publish" data to the Intel SCS database?** This variable is relevant only if you intend to install the RCS in database mode. Intel SCS includes several methods for discovering data about your platforms: • System Discovery – The Discovery Utility (`SCSDiscovery.exe`) and the Configurator can get detailed data about Intel AMT • Platform Discovery – The Platform Discovery Utility (`PlatformDiscovery.exe`) gets "top-level" data about the hardware and software of supported Intel products that exist on your platforms • Solution Discovery – Some of the Intel products that are supported by the Solutions Framework component of Intel SCS have a host plugin. You can use some of these host plugins to get detailed data about the product. For example, the Intel SSD Pro Series plugin supports this option. When the RCS is installed in database mode, you can store the data collected by these components in the Intel SCS database. Storing this data in the Intel SCS database will require more hard disk space on the computer running the SQL Server that hosts the database.

Environment Variables Checklist	
8	**Do you need to use more than one Active Directory Organizational Unit (ADOU)?** This variable is relevant only if both of these are true: • You intend to integrate Intel AMT with the security infrastructure of your network's Active Directory. • You have systems with disjointed hostnames in your organization. (A disjointed hostname occurs when the hostname in the Domain Name System (DNS) is not the same as the hostname assigned in the Windows operating system.) When integrated with AD, during configuration Intel SCS sends a request to the AD to create a Computer object representing the Intel AMT device. The object is stored in the ADOU that you define in the configuration profile. Most organizations store all these objects in the same ADOU specifically created for Intel AMT objects. But if you have disjointed hostnames in your organization, storing all Intel AMT objects in the same ADOU is not recommended. If you have disjointed hostnames, this means that when configuring Intel AMT you must: • Make sure that the FQDN configured in the Intel AMT device can be resolved by the DNS in your network. (This requirement is always true, even if you do not have disjointed hostnames). Because the hostname in the OS is not the same as the DNS record, this means that you must define (in the configuration profile) one of the options that will construct the FQDN correctly. You can do this using the **DNS Lookup FQDN** option or using a dedicated network settings file. • Make sure that Intel SCS uses the hostname in the operating system to create the AD object. This means that you must select the **Always use the OS Host Name for the new AD Object** option in the configuration profile. This combination of requirements means that the Common Name of the AD object will not be the same as the DNS record. This means that finding the correct object in the ADOU is only possible by searching the value of the `DNSHostName` property of the AD object. Unlike the Common Name property, the `DNSHostname` property is NOT indexed. This means that the more objects exist in the ADOU, the longer it will take to find the correct object. This increased time used for searching will increase the time required to complete any operations on Intel AMT that involve Kerberos authentication. To prevent this it is recommended to distribute the Intel AMT objects over a number of different ADOUs, and preferably locate these ADOUs on different domains. **Note:** • You can only define one ADOU in each Intel AMT configuration profile. This means that if you want to store objects in different ADOUs, you will need to create a different profile for each ADOU. Then you also need to make sure that the correct systems are configured using the profile containing the correct ADOU. • Depending on the AD topology (and regardless of the number of ADOUs you define), creating new AD objects takes time to replicate to all relevant servers. This means that Kerberos authentication will only succeed after replication has completed. Before trying any use case that uses Kerberos authentication, make sure that replication has completed.

3 Scalability Example Data

Providing concrete answers for expected configuration times of Intel AMT in a large scale deployment has always been problematic. This is mainly because creating a test environment with tens of thousands of real physical systems is just not possible. And running scalability testing on a real production environment is also not possible (who would agree to put their production environment at risk?).

The alternative that we used for our scalability testing was to create a real physical network environment, but use virtual machines to emulate the Intel AMT systems. Each scalability test was run against an increasing number of these emulator systems (10,000; 20,000; 50,000 and 100,000).

Using emulators creates a different problem. Emulators do not have a physical Intel AMT device. This means that the time it takes to communicate with Intel AMT on a physical system is not accounted for when using emulators. To counter this problem, we ran additional tests on 50 physical systems to get the average time used to communicate with Intel AMT. We then added this average time as a programmed delay in the emulators. Although this cannot provide 100% accuracy, it means that the data produced by the scalability tests using emulators is much closer to the expected results from physical systems.

Note:

The scalability tests were run on one specific network environment setup. Network environments can vary in almost every one of many, many different parameters. The data returned by these tests can only be an indication of what you might expect in your own network environment.

For background information about the setup used to run the scalability tests, see:

- Basic Profile and Full Profile Definitions on the next page
- Environment Setup on page 8

To go straight to the results, see:

- Configuration Data Results on page 9
- Reconfiguration Data Results on page 10
- Unconfiguration Data Results on page 11
- Maintenance Data Results on page 12

3.1 Basic Profile and Full Profile Definitions

Intel AMT supports a lot of different settings and options that you can define in the configuration profile. It would be impractical (and unnecessary) to run scalability tests on every single combination of these settings and options. Instead, we created two different profiles:

- **Basic Profile** – This profile contained the basic settings that most organizations would probably be interested in configuring.
- **Full Profile** – This profile contained every possible setting and option, with most options containing the maximum permitted number of entries. Probably no organization would want or need to configure Intel AMT with all these settings. This profile was created to test the "worst case scenario" for configuration times and other parameters.

This table compares the contents of the "Basic" and the "Full" profiles used during the scalability testing.

Profile Setting	Basic Profile	Full Profile
Active Directory Integration	Yes	Yes
Access Control List	1 Active Directory User	• 7 Digest Users • 32 Active Directory Users
Home Domains	No	5 Home Domains
Remote Access	No	• 2 Management Presence Servers • 2 Remote Access Policies
Trusted Root Certificates	No	1 trusted root certificate
Transport Layer Security (TLS)	Yes	Yes
Mutual TLS	No	Yes
WiFi Setups	No	15 WiFi setups
802.1x Setups	No	Yes
End-Point Access Control (EAC)	No	Yes
Certificates	1 certificate (for TLS)	3 different certificates
Network Settings	Both profiles contained the default settings: • FQDN will be the same as the Primary DNS FQDN • IP will be taken from DHCP	
System Settings	Both profiles contained the default settings defined in the System Settings window of the profile. (Changing these settings in the profile has a negligible impact on configuration times.)	

3.2 Environment Setup

Every organization has different hardware and software setups on the Servers that they use in their network. It would be impossible to run scalability tests for all these types of setups. The supported operating systems (for the RCS) and SQL Server versions (for database mode) are listed in the `Intel(R)_SCS_User_Guide.pdf`.

Although Intel SCS does not specify any specific hardware requirements, you should carefully select the Server(s) that will run the RCS instance(s). The RCS will obviously benefit from having a strong CPU configuration and a large amount of RAM.

This table describes the setups of the Servers that were used during the scalability testing.

Component	Setup of the Computer Running the Component
RCS	• Operating system: Windows Server 2008 R2 • CPU: 8 logical processors Intel® Xeon® E5345 @ 2.33GHz 2.33 GHz (2 processors) • RAM Memory: 16 GB • Hard Disk: 136 GB
AD Domain Controller	• Operating system: Windows Server 2008 x64 • CPU: 4 logical processors Intel® Xeon® E5420 @ 2.50GHz 2.74 GHz (4 processors) • RAM Memory: 4 GB • Hard Disk: 30 GB • Active Directory Version: 2008
Certification Authority	• Operating system: Windows Server 2008 x64 • CPU: 2 logical processors Intel® Xeon® E5420 @ 2.50GHz 2.52 GHz (2 processors) • RAM Memory: 1 GB • Hard Disk: 30 GB • CA Type: Enterprise 2008 R2
SQL Server	• Operating system: Windows Server 2008 x64 • CPU: 2 logical processors Intel® Xeon® E5420 @ 2.50GHz 2.64 GHz (2 processors) • RAM Memory: 4 GB • Hard Disk: 66 GB • SQL Server Version: Microsoft SQL Server 2012 Enterprise

3.3 Configuration Data Results

	10,000 Systems		20,000 Systems		50,000 Systems		100,000 Systems	
	Basic Profile	Full Profile	Basic Profile	Full Profile	Basic Profile	Full Profile	Basic Profile	Full Profile
Average configuration time per system (seconds)	86.25	221.56	87.57	229	137.88	249	199.26	270.73
Total configuration time (hours)	1.21	3.1	2.47	6.4	9.6	17.4	27.8	37.76
Maximum RAM memory usage on the computer running the RCS	213 MB	236 MB	222 MB	236 MB	226 MB	248 MB	227 MB	245 MB
Maximum simultaneous RCS threads*	421	423	420	421	421	422	420	421
Maximum parallel calls to AD*	200	200	200	200	200	200	200	200
Maximum parallel calls to the CA*	200	200	200	200	200	200	200	200
Total transactions to the database	124564	121255	248448	242012	588082	662642	1202621	1231387
Disk usage of RCS log files	434 MB	650 MB	845 MB	1.26 GB	2.1 GB	3.19 GB	4.13 GB	5.42 GB
Disk usage of Intel SCS database	11 MB	31 MB	23 MB	68 MB	143 MB	168 MB	283 MB	342 MB
* These parameters are controlled by the value of a configurable RCS setting. In this example, the default setting of 200 was used. For more information, see MaxParallelAMTOperations on page 19.								

3.4 Reconfiguration Data Results

	10,000 Systems		20,000 Systems		50,000 Systems		100,000 Systems	
	Basic Profile	Full Profile	Basic Profile	Full Profile	Basic Profile	Full Profile	Basic Profile	Full Profile
Average reconfiguration time per system (seconds)	93.44	230.59	95.07	233.19	92.33	230.28	90.05	225.743
Total reconfiguration time (hours)	1.31	3.22	2.66	6.5	6.45	16.05	12.6	31.5
Maximum RAM memory usage on the computer running the RCS	192 MB	207 MB	198 MB	207 MB	216 MB	217 MB	222 MB	212 MB
Maximum simultaneous RCS threads*	423	425	420	421	419	427	426	425
Maximum parallel calls to AD*	200	200	200	200	200	200	200	200
Maximum parallel calls to the CA*	200	200	200	200	200	200	200	200
Total transactions to the database	135002	141545	269304	282508	651888	705389	1344899	1413643
Disk usage of RCS log files	440 MB	719 MB	863 MB	1.38 GB	2.1 GB	3.51 GB	4.31 GB	7.03 GB
Disk usage of Intel SCS database	11 MB	15 MB	23 MB	33 MB	51 MB	73 MB	115 MB	147 MB
* These parameters are controlled by the value of a configurable RCS setting. In this example, the default setting of 200 was used. For more information, see MaxParallelAMTOperations on page 19.								

3.5 Unconfiguration Data Results

	10,000 Systems		20,000 Systems		50,000 Systems		100,000 Systems	
	Basic Profile	Full Profile	Basic Profile	Full Profile	Basic Profile	Full Profile	Basic Profile	Full Profile
Average unconfiguration time per system (seconds)	0.19	0.19	0.19	0.14	0.20	0.19	0.19	0.21
Total unconfiguration time (hours)	0.46	0.46	0.92	0.72	2.3	2.3	4.44	4.64
Maximum RAM memory usage on the computer running the RCS	197 MB	197 MB	198 MB	195 MB	208 MB	238 MB	205 MB	206 MB
Maximum simultaneous RCS threads*	218	218	218	217	219	219	218	219
Maximum parallel calls to AD*	200	200	200	200	200	200	200	200
Maximum parallel calls to the CA*	200	200	200	200	200	200	200	200
Total transactions to the database	81695	81797	163844	162795	408714	423267	821737	812784
Disk usage of RCS log files	80 MB	80 MB	161 MB	142 MB	400 MB	403 MB	790 MB	727 MB
Disk usage of Intel SCS database	8 MB	8 MB	17 MB	17 MB	42 MB	41 MB	84 MB	86 MB
* These parameters are controlled by the value of a configurable RCS setting. In this example, the default setting of 200 was used. For more information, see MaxParallelAMTOperations on page 19.								

3.6 Maintenance Data Results

You can use Intel SCS to perform these maintenance tasks on Intel AMT:

- **Synchronizing the Clock** – The Intel AMT device contains a clock that operates independently from the clock in the host operating system. For devices configured to use Kerberos authentication, it is important to synchronize the device clock with the clock of a computer in the network. When the clock is not synchronized, Kerberos authentication with the device might fail. For Kerberos enabled devices, Intel recommends to synchronize the clock at two week intervals.
- **Synchronizing Network Settings** – After configuration, the Intel AMT device contains IP and FQDN settings that management consoles use to connect to the device. Changes in the network environment or the host operating system might make it necessary to change the settings in the device.
- **Reissuing Certificates** – The certificates configured in Intel AMT (for TLS, EAC, Remote Access, or 802.1x) are only valid for a specified time. These certificates must be reissued before they expire. Intel recommends that you schedule this maintenance task to run a minimum of 30 days before the certificate expiration date.
- **Replacing Active Directory Object Passwords** – If an Intel AMT device is configured to use Active Directory (AD) Integration, an object is created in the AD Organizational Unit specified in the profile. The object contains a password that is set automatically (not user defined). If the ADOU has a "maximum password age" password policy defined in AD, the password must be replaced before it expires. Intel recommends that you schedule this maintenance task to start a minimum of 10 days before the password is set to expire.
- **Changing the Default Admin Password** – For increased security, it is recommended to change the password of the default Digest admin user (of Intel AMT) at regular intervals.

Intel SCS includes two different methods for running maintenance tasks on Intel AMT:

- **Using the CLI** – The maintenance request is sent by the Configurator from the system to the RCS.
- **Using Jobs** – This option is available from the Console, but only when the RCS is installed in database mode.

You can use either of these methods to run any of the maintenance tasks separately, or all of the maintenance tasks together. For more information about maintenance tasks, refer to the "Maintenance Policies for Intel AMT" section of the `Intel(R)_SCS_User_Guide.pdf`.

For the scalability testing, we ran three separate tests for each of these maintenance methods. One test was to perform all maintenance tasks. And the other two tests were to renew the AD password (of the Intel AMT AD object) and renew the certificates configured in Intel AMT.

Note:

The results tables contain results for 1,000 systems. This is because when running maintenance tasks, most of the values remain more or less the same regardless of the number of systems. For example, running maintenance on 10,000 or 100, 000 systems does not significantly increase the maximum amount of RAM used by the RCS. The values that do increase according to the number of systems (total time, disk usage of RCS log files, and disk usage of the Intel SCS database) increase in almost linear increments. For these values, simply multiply the value in the table by the number of thousands of systems (for example, for 10,000 systems, multiply by 10).

3.6.1 Maintenance Using the CLI

	All Maintenance Tasks (1,000 Systems)		Renew AD Password Only (1,000 Systems)		Renew Certificates Only (1,000 Systems)	
	Basic Profile	Full Profile	Basic Profile	Full Profile	Basic Profile	Full Profile
Average time per system (seconds)	102.37	242.72	99.77	245.66	102.4	244.37
Total time (seconds)	553	1265	538	1280	556	1271
Maximum RAM memory usage on the computer running the RCS	177 MB	193 MB	176 MB	188 MB	177 MB	211 MB
Maximum simultaneous RCS threads*	421	427	422	426	421	428
Maximum parallel calls to AD*	200	200	200	200	200	200
Maximum parallel calls to the CA*	200	200	200	200	200	200
Total transactions to the database	13457	13914	13446	13876	13437	15993
Disk usage of RCS log files	42 MB	65 MB	42 MB	65 MB	41 MB	65 MB
Disk usage of Intel SCS database	1.02 MB	1.34 MB	0.96 MB	1.34 MB	1.06 MB	1.34 MB
* These parameters are controlled by the value of a configurable RCS setting. In this example, the default setting of 200 was used. For more information, see MaxParallelAMTOperations on page 19.						

3.6.2 Maintenance Using Jobs

	All Maintenance Tasks (1,000 Systems)		Renew AD Password Only (1,000 Systems)		Renew Certificates Only (1,000 Systems)	
	Basic Profile	Full Profile	Basic Profile	Full Profile	Basic Profile	Full Profile
Average time per system (seconds)	N/A	N/A	N/A	N/A	N/A	N/A
Total time (seconds)	1247	2330	1342	2292	1349	2347
Maximum RAM memory usage on the computer running the RCS	58 MB	61 MB	62 MB	62 MB	56 MB	62 MB
Maximum simultaneous RCS threads*	119	121	121	121	119	122
Maximum parallel calls to AD*	200	200	200	200	200	200
Maximum parallel calls to the CA*	200	200	200	200	200	200
Total transactions to the database	20469	23998	22811	22715	24176	24633
Disk usage of RCS log files	41 MB	65 MB	42 MB	65 MB	43 MB	66 MB
Disk usage of Intel SCS database	0.90 MB	1.28 MB	1.02 MB	1.34 MB	0.96 MB	1.34 MB
* These parameters are controlled by the value of a configurable RCS setting. In this example, the default setting of 200 was used. For more information, see MaxParallelAMTOperations on page 19.						

Note:

As you can see from these results, running maintenance tasks using jobs takes more time than running maintenance tasks using the CLI. This is because the RCS automatically controls the number of simultaneous maintenance operations. Although using jobs take more time, it is one of the methods you can use to reduce the possibility of network overload and failures (see item #4 in the checklist of Environment Variables on page 2).

4 Scalability Factors

This section describes additional information that will help you to plan your deployment.

4.1 Geographical Locations

When selecting on which computer to install the RCS, make sure that you take into consideration the physical distances that exist between your network infrastructure components. Although average network speeds are much higher than they were in the past, the distances that network traffic needs to travel is still a scalability factor. In addition to communicating with each Intel AMT system, the RCS also needs to communicate with several other network components (for example DNS, AD, CA, etc.). Obviously, the closer that the RCS is located to the Intel AMT systems and these network components, the faster configuration/maintenance will complete.

If your organization has multiple sites spread around the globe, the considerations that you used when defining your network infrastructure can also be applied when deciding where to install the RCS. For example, many organizations create sub networks for major geographic locations (USA, Europe, Asia, etc.) with each sub network having its own local network server infrastructure for DNS, AD, CA, etc. In a situation like this, it makes sense to install an instance of the RCS in each sub network. Each instance of the RCS would configure/maintain the systems that are managed using the network components in their sub network.

4.2 Multiple Instances of RCS

As you can see from the tables in the Scalability Example Data section, a single instance of the RCS is capable of configuring and maintaining 100,000 Intel AMT systems. But when dealing with such large numbers of systems, it is usually recommended (or often necessary) to install multiple instances of the RCS. As described in the previous sections, these are the main parameters that you will use to decide how many instances of RCS you need to install:

1. The total number of Intel AMT systems in your organization.
2. The window of availability for configuration/maintenance of Intel AMT (see items #2 and #3 in Environment Variables on page 2).
3. The total estimated time it will take to configure/maintain Intel AMT (see the tables in Scalability Example Data on page 6).

Note:

The `/RCSBusyRetryCount` parameter can also help to automatically spread out the load on the RCS when it is busy (see RCSBusyRetryCount Parameter on page 18).

These sections include information that is important to understand when using multiple RCS instances:

- Synchronizing RCS Instances on the next page
- Load Balancing or Scripts on page 17

4.2.1 Synchronizing RCS Instances

Each instance of the RCS is a totally separate entity and does not know of the existence of other RCS instances. This also means that each RCS handles its own data storage and cannot access data stored by a different instance of the RCS. Where data is stored depends on the installation mode that you select:

- **Non-database Mode** – Configuration profiles are stored in an XML file (`Profile.xml`) on the computer running the RCS.
- **Database Mode** – All data is stored in the specific SQL Server database that was created for Intel SCS during installation of the specific RCS instance. This means, of course, that in this mode you will need to create a separate SQL database for each instance of the RCS. Each database will only contain data about the Intel AMT systems that were configured by the instance of the RCS connected to that instance of the database. The Console component includes an option to connect to the different instances of the RCS. (It is not necessary to install multiple Consoles. You can use the same Console and switch between the different instances of the RCS/database.)

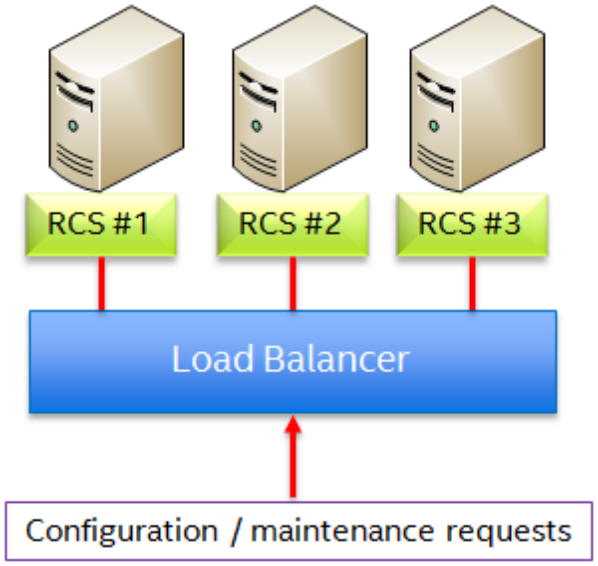
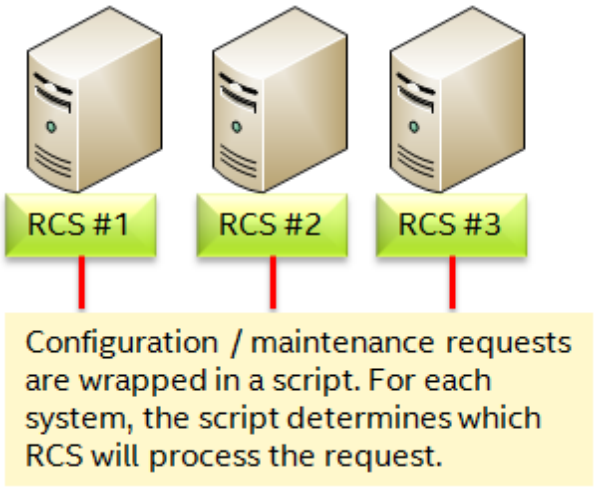
Intel SCS does not currently include any built-in options or capabilities for synchronizing data between the different instances of the RCS.

But there are only two types of data that you might want to synchronize:

- **Configuration Profiles** – You only need to synchronize the configuration profiles if you need to make sure that all profiles in all instances of the RCS contain the same settings. For example, if you are using a Load Balancer, you must synchronize the configuration profiles regularly (see Load Balancing or Scripts on the next page). But if you are using a script to channel requests to specific RCS instances, you probably do not need to synchronize profiles. You just need to make sure that each RCS instance contains the correct profiles for the systems from which configuration requests will be sent.
- **Digest Master Password** – The configuration profile includes an option to define the Digest admin password of Intel AMT using a Digest Master Password (DMP). When using this option, the RCS calculates a different (unique) password for each device using a secret key (the DMP). The DMP is defined for each RCS via the Console in **Tools** > **Settings** > **Security Settings**. If you use this option, it is recommended to define the same DMP in each instance of the RCS and keep them synchronized. By using the same DMP in all instances of the RCS, you will enable all instances of the RCS to communicate with all your Intel AMT systems. (When using this option with a Load Balancer, you must keep the DMP synchronized.)

4.2.2 Load Balancing or Scripts

This table describes two methods that you can use to channel configuration and maintenance requests to the RCS instances.

Using a Load Balancer	Using a Script
	
When using this method, the Load Balancer automatically decides which RCS will process the requests. This means that you have no control over which RCS will process configuration and maintenance requests sent from a system. Using this method means that you must make sure that each instance of the RCS has the exact same copies of profiles as all the other instances. Failure to maintain synchronization of the profiles will result in systems being configured with incorrect settings, or even failure of configuration and maintenance requests. For these reasons, this method is NOT recommended if either of these are true: • You are using database mode • You want to split control of systems according to separate geographical locations	Using this method gives you complete control over which RCS will process requests from a specific system. For example, you can create a script to check in which domain the system is located and then route the request to the closest RCS. In database mode, using this method also means that you can control in which instance of the Intel SCS database a specific system will be stored.

4.3 RCSBusyRetryCount Parameter

The `ConfigureViaRCSOnly` and `MaintainViaRCSOnly` commands include a parameter named `/RCSBusyRetryCount`. This parameter defines the number of times to resend the request to the RCS if the RCS returns a status of busy. You can define a maximum number of 100 retries. This retry mechanism creates random sleep periods of between 30 and 270 seconds before sending each new request. Using this parameter is highly recommended since the random sleep periods will also help to automatically spread out the load on the RCS when it is busy.

4.4 RCS Registry Settings

When you install the RCS, several RCS settings are stored in the registry of the computer on which the RCS is installed. For Intel SCS 10, the registry settings are stored in this location:

- 32-bit operating systems: `HKLM\SOFTWARE\Intel\Intel(R) Setup and Configuration Software\10\RCS\GeneralSettings`
- 64-bit operating systems: `HKLM\SOFTWARE\Wow6432Node\Intel\Intel(R) Setup and Configuration Software\10\RCS\GeneralSettings`

Two of these settings are parameters that you can change (if necessary) to make adjustments to how the RCS operates. For more information, see:

- MaxParallelAMTOperations on the next page
- TCPTimeout on the next page

Note:

- It is not recommended to make any changes to the RCS settings directly in the registry. Instead, you can configure them via the Console in **Tools** > **Settings** (except for `MaxParallelAMTOperations`).
- You can also change the values of these settings using the WMI method `SetRCSServiceSettings` in the RCS API class `RCS_Admin_RemoteConfigurationService`. Documentation for the RCS API methods and classes is available in the download package of the Software Development Kit of Intel SCS (also available from the Intel SCS website).

4.4.1 MaxParallelAMTOperations

The `MaxParallelAMTOperations` setting determines the maximum number of operations that can be performed concurrently by the RCS. These operations include configuration, unconfiguration, and maintenance requests sent to the RCS by the Configurator.

The default value is 200 parallel operations. (Minimum value: 10. Maximum value: 5000.)

The value of this setting also defines

- The maximum parallel calls to AD
- The maximum parallel calls to the CA

So, with the default setting of 200, the maximum number of parallel calls to the AD and the CA (when applicable) is also 200.

It is only recommended to change this setting in these situations:

- Reduce the value if your CA or AD is a bottleneck and cannot handle 200 parallel calls from the RCS (or you just want to lower the limit).
- Increase the value if the computer on which you are running the RCS can handle a higher amount of parallel operations (and also the CA/AD). For the RCS, the factors that limit how much you can increase this value are the number of CPUs and the amount of RAM memory.

Note:

- This parameter is not relevant when using jobs (because when using jobs, the RCS automatically controls the number of simultaneous operations).
- If you want to change this value directly in the registry, you must first stop the RCS windows service. (This is not necessary if you change the value using the WMI command.)

4.4.2 TCPTimeout

The RCS communicates with the Intel AMT device using the Transmission Control Protocol (TCP). During communication, if the device does not answer within a specified time the RCS cancels the communication. The default `TCPTimeout` setting is 10 seconds. This is usually enough time for the device to respond. But if traffic over your network is slow, or the RCS is located far away from the systems, you can increase this value.

Valid values: 10 to 80 seconds.

Note:

- You can change this setting via the Console (in **Tools** > **Settings** > **Configuration Options**).
- A large `TCPTimeout` value can cause configuration/maintenance tasks to take longer than usual.

4.5 Server Maintenance Operations

This section describes some tasks that you need to manage on some of the computers running components used by Intel SCS.

4.5.1 Backing up the RCS Data

The type of installation you selected causes the RCS to store data in files or in an SQL database. If one of the data files or database tables is damaged or missing, the RCS cannot operate correctly. Thus, it is important to make a regular backup. (If you need to restore data from a backup, make sure that you stop the RCS first. After the data is restored, restart the RCS.)

If you installed RCS in:

- **Database Mode** – Schedule a regular backup of the database in SQL Server.
- **Non-Database Mode** – Make regular backups of the data files and store them in a secure location. You can use any backup method or application that will let you recover the data files when necessary. In this mode, the data files are located on the computer running the RCS. For more information about the files and their location, refer to the "Backing up Data" section in the `Intel(R)_SCS_User_Guide.pdf`.

Note:

You must also make sure that you keep backup copies of the storage keys (and their passwords) that are generated for each Intel SCS database that you create.

4.5.2 Archiving/Deleting the RCS Log Files

The log files of the RCS are located in a folder named `RCSConfServer` in one of these hidden locations:

- `ProgramData\Intel_Corporation`
- `Documents and Settings\All Users\Application Data\Intel_Corporation`

The log file is named `RCSLog.log` and records all operations and actions done by the RCS. Each time the log file becomes too large, or the RCS is restarted, the file content is moved to a new file with this format: `RCSLog.logYYYY-MM-DD-HH-MI-SS.log`.

As you can see from the tables in the Scalability Example Data section, when configuring large numbers of systems, these log files can start to occupy a lot of space on the hard disk. Intel SCS does not currently include an option to automatically delete these log files. This means that you will need to decide how and when you want to archive or delete old log files. For example, you could run a script every month to delete or archive log files that are more than a month old.

4.5.3 Managing Expired Certificates

Intel SCS does not revoke expired certificates. This means that you will need to manage the certificates in the certificate store of the computer running the Certification Authority.

5 References

Detailed background information about Intel AMT and all Intel SCS options is described in the `Intel(R)_SCS_User_Guide.pdf`. In particular, it is recommended to refer to the "Getting Started Checklist" in the "Prerequisites" section.

This table is a quick reference for some of the main terms used in this document, and where you can find more information about them.

Term	Description
Configurator	A small executable (`ACUConfig.exe`) located in the `Configurator` folder of the Intel SCS download package. You run the Configurator locally on each Intel AMT system. You can use the Configurator to configure and maintain the system locally or send the configuration/maintenance request to the RCS. For more information, refer to the "Using the Configurator" section of the user guide.
Console	The user interface to the RCS. You can use the Console to create and edit configuration profiles for supported Intel products and capabilities. In database mode, the Console also lets you view data about Intel products that was sent to the RCS. Additional options for Intel AMT are also available only in database mode. These options include monitoring Intel AMT systems and creating and running "Jobs" on multiple Intel AMT systems.
Control Modes	After configuration, Intel AMT is placed into one of these modes: • Admin Control Mode • Client Control Mode Client Control mode has some built-in security related limitations. The main limitation of this mode is that the User Consent feature is mandatory. User Consent means that redirection operations and changes to the boot process are only allowed if the end user of the computer agrees (by supplying a code). In Admin Control mode you can turn the User Consent feature on or off. Host-based configuration can only configure Intel AMT into Client Control mode. Configuration into Admin Control mode can only be performed by the RCS. For more information, refer to the "Control Modes" and "User Consent" sections of the user guide.

Term	Description
Host-based Configuration	One of the configuration methods used to configure Intel AMT. When using this method, the Configurator performs the configuration locally on the system. When necessary, communications with the AD and CA are performed by the Configurator directly from the system. **Note:** • Intel SCS supports several different configuration methods. For more information, refer to the "Configuration Methods and Intel AMT Versions" section of the user guide. • The guidelines in this document are relevant when using the RCS and the Remote Configuration methods. For more information, refer to the "Configuring Systems using the RCS" section of the user guide.
Jobs	An operation that you can run from the Console on a selected group of Intel AMT systems, defined using a filter. For more information, refer to the "About Jobs and Operations" section of the user guide.
RCS	A Windows based service that runs on a computer in the network. The RCS processes configuration and maintenance requests sent from the systems by the Configurator. The installer for the RCS (and the Console) is located in the `RCS` folder of the Intel SCS download package. For more information, refer to the "Setting up the RCS" section of the user guide.