Kofax Communication Server

Environment Guide - Platform System Manual

Version: 10.2.0

FCC COMPLIANCE STATEMENT

Information to the User

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.
- The use of a non-shielded interface cable with the referenced device is prohibited.

Change or modifications not expressly approved by Kofax could void the authority to operate the equipment.

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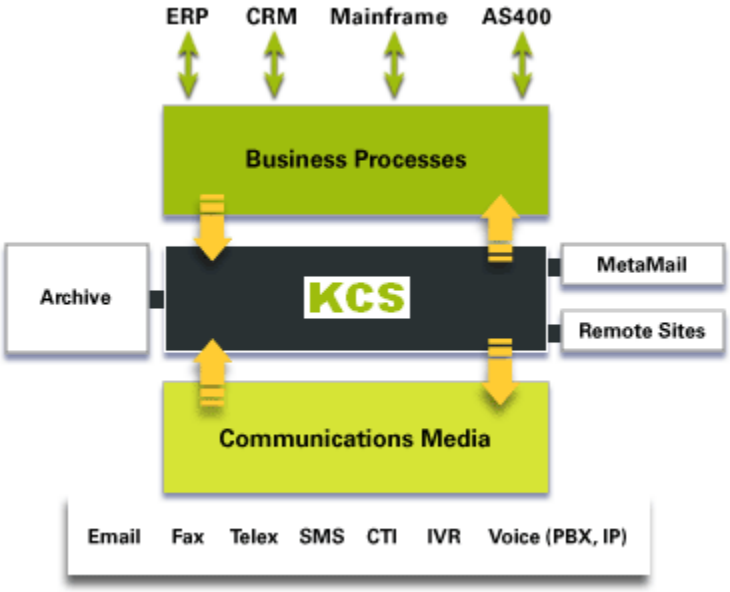
1. System Overview

1.1 General

Kofax delivers solutions for the widest range of communication tasks.



Important! The Kofax Communication Server and its components formerly used the name TOPCALL. Some screen shots and texts in this manual may still use the former name.

2. Hardware Structure

A KCS system 3xx consists of two main device types:

- Application Server
- Line Server Model 305 or 304 with Line Interfaces to PABX or PSTN

2.1 KCS Cabinets

Are all intended to be 19” rack mount but can be used as desktop devices as well.

Application Server

Runs KCS software like TCOSS Server Operating System, Archive, and Links.

The connection to the Line Server’s/Branch Boxes is via TCP/IP-LAN (preferable dedicated).

Line Server – Model 304 and Model 305

Connects to PABX or PSTN via interface modules for voice or fax transmission.

KCS Rack

With two Application Servers and accompanying Line Servers for redundancy.

3. KCS Models

3.1 Line Server

KCS Model	Description	Inter-face Slots	Line Interfaces supported	Number of fax/voice/Telex channels per interface
Model 305	Line Server for analogue and BRI/PRI Fax and Voice	2	Dual BRI TC23 Dual PRI TC24 Quad analogue TC26	4 30 (E1 ISDN) 23 (T1 ISDN) 4 (T/R)
Model 304	Line Server for analogue Fax	2	Dual analogue TC31+TC30 or TC32+TC30	2
Model 202 TELEX BranchBox	Line Server for Legacy Telex Interfaces	7	TS20 TS22 TS26+TS2T TS26+TS2V TS28	2 Telex S.19(XD) 2 Double curr. 2 for V.21 2 for V.21 France 2 Single curr.
Model 350 GSM Box	GSM mobile interface with LAN connection	-	1 GSM Interface	1 GSM (SMS only)

3.2 KCS Interface Boards

3.2.1 Interface Boards for Line Server Model 305

Basic Rate ISDN (BRI) TC23

Form Factor:	KCS Line Server Model 305 Slot
Message type:	G3 FAX, Voice
Number of lines:	2xBRI Euro ISDN
Fax/Voice channels per line:	2
Transmission speed:	2x64kBit/s, symmetric

Primary Rate ISDN (PRI) TC24

Form Factor:	KCS Line Server Model 305 Slot
Message type:	G3 FAX, Voice
Number of lines:	2xPRI (E1/T1)
Fax/Voice channels per line:	30E1/23T1
Transmission speed:	E1:2x2.048kBit/s, T1: 2x1.544kBit/s symmetric

Quad Analogue TC26

Form Factor:	KCS Line Server Model 305 Slot
Message type:	G3 FAX, Voice
Number of lines:	4
Channels per line:	1

Legacy Board Adapter TC30

Form Factor:	KCS Line Server Model 305 Slot
Slots:	1 Slot for TC31 or TC32

3.2.2 Legacy Interface Boards

Analogue Modem Line Interface Board TC32

Channels:	2 per Board
Data Pump:	Rockwell RC288DPi
Fax Group 3:	CCITT T.4, T.30
Data Transfer:	CCITT V.29 and V.27
Operation Mode	2 Fax Lines (a/b)
DTMF: **(Second Dial Stage)**	Supported

PBX Modem Line Interface Board TC31

Channels:	2 per Board
Data Pump:	Rockwell RC288Dpi
Power Supply:	TC3P (supplies up to 4 TC31)
PBX Link:	E&M / EIA/TIA 464 B, Bell DID
Fax Group 3:	CCITT T.4, T.30
Data Transfer:	CCITT V.29 and V.27

Operation Modes:	
DTMF:	Supported
DID:	Supported
DID Protocols:	Seizure Acknowledgement Delay Dial Immediate Start Wink Start

Legacy Boards (TSXX)

Please find the Information for these boards in TCOSS System Manual V1.13.

They may be used only with Line Server Model 202.

4. Which Hard- and Software Is Supported

4.1 KCS Hardware

KCS hardware is designed to the highest standards of availability and easy maintenance. It is optimized and thoroughly tested with KCS applications. Therefore optimum support and troubleshooting is guaranteed with KCS hardware. KCS takes the overall system responsibility for solutions with KCS hardware.

TC/Model 300 is not supported with Windows Server 2008 and later operating systems.

4.1.1 KCS Line Server Model 305

4.2 Supported Platforms

KCS software is supported on the following Windows platforms:

Windows Platform KCS Package	Windows 8.1, 8, 7, 10, Vista 32-bit, XP	Windows Server 2012, R2 Windows Server 2008, R2 Windows Server 2016
Kofax Communication Server (link and server components)		x
KCS Client Apps (TCfW Communication Server Client)		x
KCS Client Apps (complete)	x	

For details and restrictions see the following sections and the special package documentation.

4.2.1 Support for Windows Server 2008 – 2016

- In general, all currently supported components of the KCS Server Package 7.84.xx or later, of the KCS Link Package 2.32.xx or later, and the TCfW Communication Server Client application (part of KCS Client Applications 5.26.xx or later) work properly on a Windows Server 2008 (non-R2) based computer.
- All currently supported components of the KCS Server Package 7.88.xx or later, of the KCS Link Package 2.36.xx or later, and the TCfW Communication Server Client application (part of KCS Client Applications 5.30.xx or later) work properly on a Windows Server 2008 R2 based computer.
- Components that approach their end of sales might NOT be supported.
- The upgrade from Windows Server 2003 is NOT supported; only new installations on Windows Server 2008 are.
- The upgrade from Windows Server 2008 64 bit to 2008 R2 is supported. (TC/SNMP might not work; see TC/SNMP Manual for troubleshooting).
- TC/Model 300 with Windows Server 2008 (or later) is NOT supported.

- Hyper-V feature (hardware virtualization mode) is only supported with Windows Server 2008 R2 host (or later).
- Windows Server Core installation variant is NOT supported.
- 64-bit versions of Windows Server: See section *Restrictions for 64-Bit Versions of Windows Server*.

KCS Client Applications

Not supported, except TCfW Communication Server Client.

Unsupported Link Components

- KCS Exchange Address Templates

Unsupported Server Components

- TC/LANPRT
- TC/JUKEBOX
- TC/MA

4.2.2 Support for 64-Bit Versions of Windows Server

General

Starting with Windows Server 2008, KCS supports 64-bit versions. The KCS applications run in the x32 subsystem on the x64 Platform. This means that the file-system and registry paths of the default installations are slightly different than those on an x32 system – according to Windows conventions of x32 applications running on x64. The following table shows the differences on the KCS supported platforms (English systems):

Windows Platform	**XP, Vista, 7 x32 Version**	**Windows 7 x64 version**	**2008 x32 Version**	**2012+R2, 2008+R2 x64 Version, 2016**
KCS Client Apps file path	C:\Program Files\TOPCALL	C:\Program Files (x86)\TOPCALL	C:\Program Files\TOPCALL	C:\Program Files (x86)\TOPCALL
KCS (server + link) file paths			C:\TCOSS C:\TOPCALL	C:\TCOSS C:\TOPCALL
Registry path	HKLM\Software\ TOPCALL	HKLM\Software\ Wow6432Node\ TOPCALL	HKLM\Software\ TOPCALL	HKLM\Software\ Wow6432Node\ TOPCALL

KCS Printer Driver

The KCS Printer Driver is available as x32 and as x64 version. Depending on the platform, the respective version is installed automatically.

KCS Performance Counters

If you use Performance Counters on Windows Server 64-bit version, you will have to start the service “Performance Counter DLL Host” and set it to start automatically. See section *8.2 KCS Performance Counters* for details.

The tool TC/PerfLog supports only Mode-0 on Windows Server 64-bit version. For details see the *TC/PerfLog Technical Manual*.

TC/Web

When installing TC/Web on Windows Server x64 version, you have to set “Enable 32-Bit Applications” to true. See *TC/Web Installation and Configuration Manual*.

Restrictions for 64-Bit Versions of Windows Server

- General restrictions of Windows Server 2008 apply
- Acrobat Reader is not supported for document conversion; use the internal PDF converter for conversion of PDF files (license “Converter PDF format to TCI” required, also for conversion PDF to TIFF)
- JetForm is not supported
- No PS or PCL printer drivers instead of the KCS printer driver are supported for document conversion

4.3 Supported Software

No third-party server software (e.g. Exchange server, Notes server …) is allowed on a KCS server. This kind of software might be hard to uninstall or to transfer to another system.

See also restrictions in KCS Package Manual.

Provided that that the KCS server has sufficient RAM, the following software is allowed but not supported:

- All Programs, Tools and Applications that are part of supported Windows operating systems
- All Applications that are required for the document converter (TC/DC)
- Control It (formerly named REMOTLY POSSIBLE) for remote installation and maintenance.

Other software may be used as well, but will not be tested by Kofax. In case of problems Kofax might request to completely remove third-party software from our server to isolate the problem.

4.3.1 Different Versions of KCS Software

On a single computer, all KCS components (server, links, client) must belong to the same KCS version.

4.4 Third-Party Hardware Support

4.4.1 General

The market increasingly requests support of standard server hardware. Many companies have strong partnerships with hardware vendors or internal policies regarding hardware to use. Typically those customers have maintenance agreements with hardware vendors like IBM, Compaq or HP who take responsibility for all their hardware.

Delivering turnkey solutions with both proven hardware and software remains one of the major strengths of Kofax. By opening our architecture to allow installation of all KCS software on Microsoft certified servers we enable additional business with hardware vendor centric companies or at least make it easier by being able to offer this option.

4.4.2 How to Find a Compatible Machine

The description is divided in three steps:

In the first step you have to check the standard requirements which are **minimum requirements**. So there is no discussion about to leave one of the conditions out. The second step describes “how to use the Microsoft hardware compatibility list”.

4.4.3 Minimum Requirements

For a compatible machine the following parts are significant. Pay attention not only to a single component. Most hardware related problems result from a combination of components and drivers.

Note: The running machine has to recover independently after a power failure.

Component	requirements	Remarks
Processor:	single CPU	Speed oriented on market standard. (e.g. 1.5 GHz)
Memory:	1 GB	For minimum memory requirements see operating system demand and the system performance section in this manual.
Hard disk:	single	KCS software requires around 500 MB of disk space. Additional space is required for the TCOSS file structure. The proper calculation of the file structure size includes the consideration of the number of users, recipients, short time archive, send orders, number of files, etc. See system performance section for further information.
Ethernet (LAN):	one	100 Mbit/s or faster. If there is no number chip for licensing available (e.g. via parallel port dongle TC93) then the LAN MAC address is used for licensing (use TP80.DLL V7.11.06 or later)

Notice: Third-party hardware has to meet all legal requirements for installation in the respective country (e.g., CE, UL, CSA).

For further information about special hardware requirements regarding different KCS server applications refer to the **product related requirement** list at the end of this chapter.

4.4.4 Microsoft Hardware Compatibility List

It is possible to use third-party hardware instead of Kofax certified models even these servers have to meet all of the Microsoft Windows Logo requirements. (Only listed servers are supported!) **There will be no support for servers assembled from HCL components!**

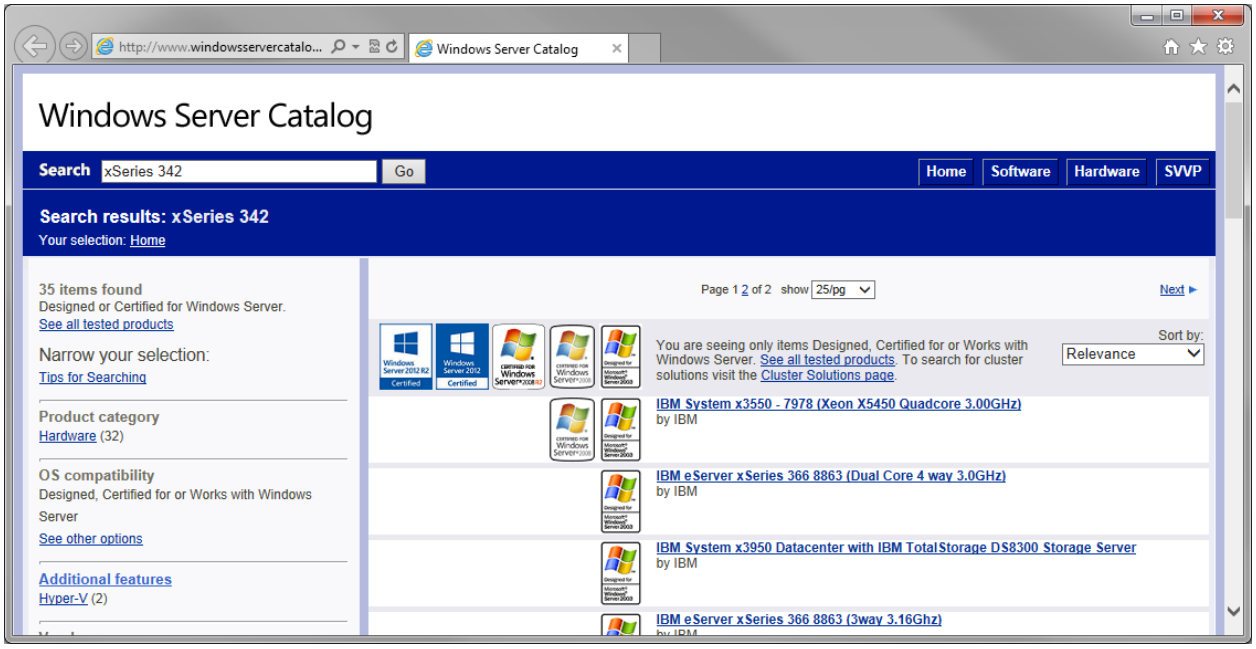
Before you check the Microsoft web site for further information let’s have a look to “how to figure out the exact server name”. The server manufacturers have all different methods to label their machines. Often it is hard to figure out the exact model or version of a model. This is due to the fact that not all companies show the model name on their different technical equipment.

E.g.: The HP “ProLiant DL360” can be found as generic type as well as in different technical equipment versions like “ProLiant DL360 6/1GHz-256Kb (2P)”. So we recommend that you figure out the exact version and you should use only this one to check in the database.

Compatibility with Windows Server operation systems can be checked on the following web site: http://www.windowsservercatalog.com/.

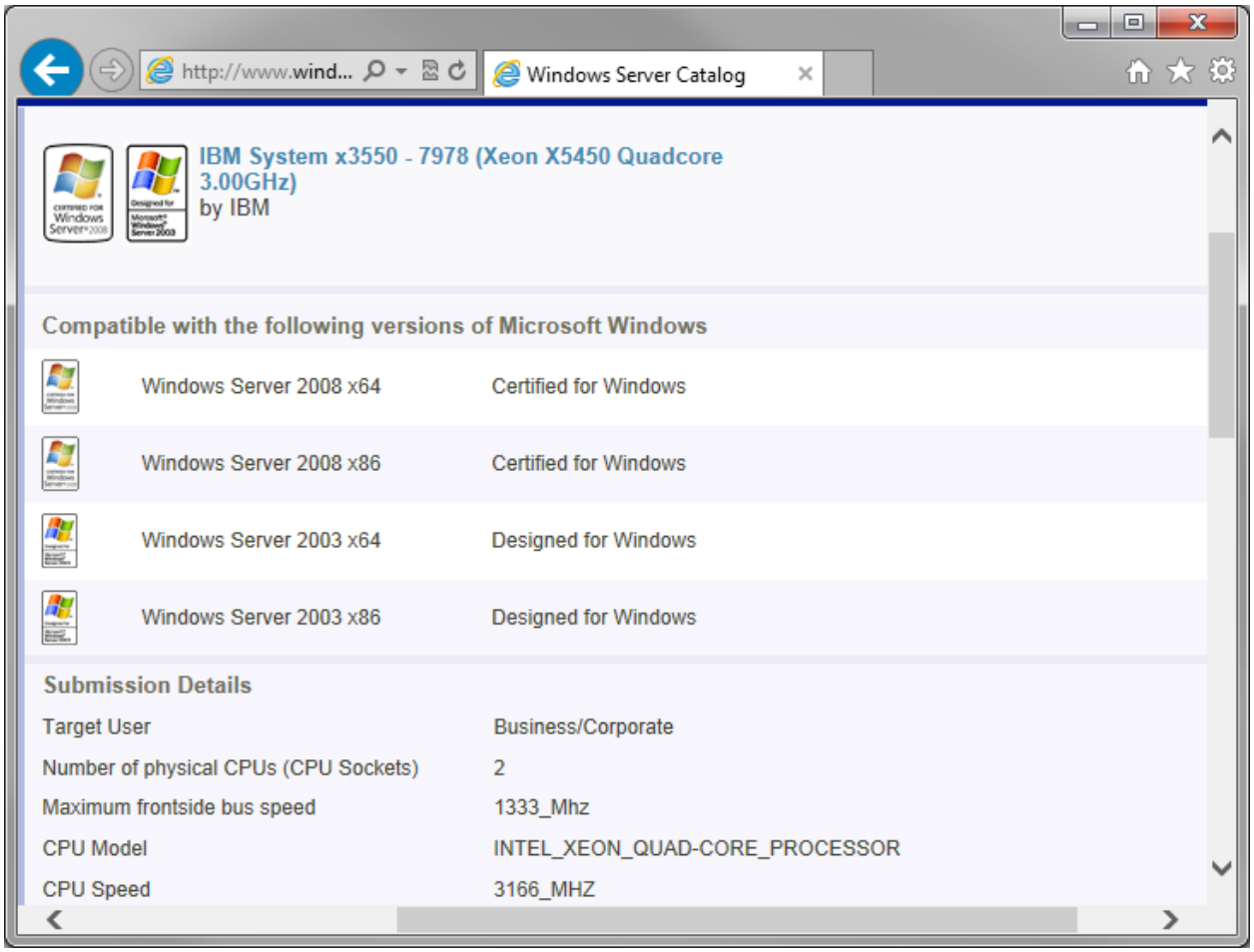
Step one

Enter the server model, for example “xSeries 342”.



Step two

Find your computer in the list and click it to show detailed information. For example:



Click on the second from top in the list. The information in detail:

The computer has to be combatible with a version of Windows supported by KCS. This is what is necessary to be KCS compliant. Look for one of the following icons:

4.4.5 Prerequisites

The fulfillment of the criteria of all previous steps (Minimum Requirements, Microsoft Hardware Compatibility List) is the base for a proper cooperation between third-party hardware, operating system and KCS server software.

Notice: Before you start installing KCS software it is mandatory that the OS of the server is running without error and the network is up and working.

4.4.6 Maintenance

Kofax takes responsibility for all KCS applications; the customer takes responsibility for the hardware and the operating system. Hardware support of third-party hardware is not included in KCS maintenance contract.

Note: In case of hardware related problems, Kofax reserves the right to demand the use of KCS server hardware, in order to solve above mentioned problems. E.g.: blue screens, Dr. Watson, Network

4.4.7 Product Related Requirements

The table below should help you to figure out what special hardware you need to run KCS server software.

Art. no.	CPU (speed)	RAM (MB)	Hard disk	Serial	Parallel	PCI slots	Ethernet LAN	Token Ring LAN	CD-ROM, Floppy, VGA	CD-Writer	SCSI Adapter
Standard Hardware Requirement	single	*(2)	single *(1)	-	-	-	1	-	*(7)	-	-
TCOSS Server	single	256	single *(1)	-	-	-	1	-	*(7)	-	
TCOSS TANDEM Primary/Secondary	single	256	single *(1)	[1] *(5)	-	-	2	-	*(7)	-	
Status Agent	single	256	single *(1)	[2] *(5)	-	-	1	-	*(7)	-	
TCOSS Archive Server	single	256	single *(1)	[1] *(3)	-	-	1[2]	-	*(7)	1*(4)	[1] *(3)
KCS Link Server	single	256	single *(6)	-	-	-	1	-	*(7)	-	-

Legend:

[Optional], (extra information see below)

1) The minimum hard disk size depends on one hand on operating system, service packs, optional needed software (like office) and on the other hand on the TCOSS file structure. The proper calculation of the file structure size depends on the number of users, recipients, short time archive, send orders, files, etc. See section system performance for further information.

2) For minimum memory requirement see operating system requirement as well as system performance section.

3) If you use TC/Juke and the POINT Juke Box Manager you will need a serial or a SCSI interface to connect the Jukebox with the KCS.

4) If you use TC/Juke in "semi-automatic" mode you need a CD-writer which is supported from POINT

5) The Number of serial ports depends on usage of serial line for status information negotiation. For further information see manual.

6) The minimum hard disk size depends on operating system, service packs, optional needed software (like office, OCR) and on the number of installed KCS links. For further information see Link manuals.

7) For installation purpose a standard VGA-adapter is needed and optionally a floppy drive or a CDROM drive.

4.4.8 Known Issues on Outdated Third-Party Hardware

If running up-to-date KCS applications under modern operating systems like Windows 2008 on outdated hardware which is not listed on Microsoft HCL, it must be taken into account that there is a higher risk that any issues may occur during KCS installation and operation.

This chapter summarizes problems and hardware related issues which have already been observed on particular outdated hardware.

Tyan Mainboard Thunder HESL-T S2688 Running Windows 2008

TCP connection problems were observed, documented in the *SPR00054023: KCS FoIP Configuration Utility cannot open local port under Win 2008 OS* and huge communication problems between TCOSS instances in the ASP Tandem Server were observed, too.

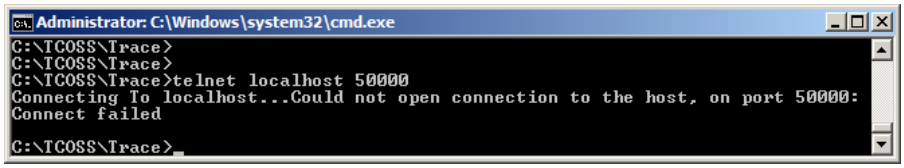
The main problem is that around 15-20 minutes after machine reboot, each attempt to make a synchronous (blocking) TCP Connect to any existing IP address (remote or even localhost) but to a non-existing port number (no listener on it) remains hanging instead of returning corresponding error saying that the port is not reachable.

During first around 15 minutes after machine reboot this problem does not occur.

Finally, the problem has been isolated on new Windows 2008 installation on this main board, without any KCS software, without any LAN card in the following way:

Open command line and try to open a Telnet session to localhost and not-existing port number 50000.

During the first 15 minutes after machine reboot it returns properly with an error:



Later on, it remains hanging in the “Connecting to localhost ….” status:

4.5 Software Prerequisites

To ensure that Kofax Communication Server installs and executes properly, following is the list of applications\software which should be installed before installing Kofax Communication Server:

1) Microsoft .Net Framework 2.0
2) Microsoft .Net Framework 3.5 (required by multiple applications)
   Note: Installation of .Net Framework 3.5 on Windows 2012 R2 may require manual steps. Refer https://support.microsoft.com/en-us/kb/3002547

3) Microsoft .Net Framework 4.x (required by Kofax Capture Connector)
Note: Although the documentation mentions to install .Net Framework 4.0, but it is recommended (and easier) to install .Net Framework 4.5.

4) Kofax Capture (required for Kofax Capture Connector)

5) Lotus Notes Client (for TC/LINK-LN and TC/MWA-LN)

6) The default installation path of TC/Archive requires access permissions to folder E:\CDTemp.

7) TC/Probe and TC/Report requires SA user credentials of an SQA Database.

8) Internet Information Server 7 or higher version (for KCS Portal and TC/Web)

4.6 Installing KCS on Different Drive

Default installation directory for KCS is C:. If you need to install KCS on any other location, create the following registry keys (along with the path) and add the desired installation path for these registry key before starting the KCS setup.

Registry key	Default Installation Path	Other Installation Path (Value)
HKEY_LOCAL_MACHINE\SOFTWARE\TOPCALL\Boot\RootDir	C:\TCOSS	D:\TCOSS
HKEY_LOCAL_MACHINE\SOFTWARE\TOPCALL\Boot\RootDir2	C:\TOPCALL	D:\TOPCALL

Note 1: Once the installation is complete, you must not modify these registry key values.

Note 2: You can modify the drive to install Kofax Communication Server, but you should not modify the default folder names, that is, the installation folder names should always remain TCOSS and TOPCALL.

Important: All KCS manuals describe the content using the default installation directory/path, that is, C:\TCOSS or C:\TOPCALL. If you have changed the default installation directory/path before the KCS installation, please read any directory/path according to your respective installation.

The following KCS applications can now be installed to another drive:

- TCfW
- TC/Monitor
- TC/Web
- TCOSS
- LINK FI
- VRS
- MakeTCOSS
- WCONFIG
- Tandem Server
- FoIP
- LINK MFP
- IP Printer
- LINK SM
- LINK MX7
- LINK LN
- LINK SC7

4.7 Required Windows User Permissions

This chapter describes the minimum user permissions for different KCS activities. In order to keep the description as simple as possible the following user types are considered:

- Administrative User: This is any user that is part of the local administrators group. It also applies to the System Account for services. Activities that require such a user are described as activities that require administrative permissions. In case of interactive applications this may include to run an activity as Administrator.

- Standard User: This is any user that is part of the local users group but not part of the local administrators group. It also applies to the Local Services and Network Services account. Activities that work with such a user are described as activities that do not require administrative permissions. Of cause, these activities can also be done by Administrative users.

Here is a summary:

Activity, Program	Administrative permissions required?
Setup of any KCS Component	Yes
TCfW Communication Server Client	No
KCS Monitor (if start/stop of KCS service is not used)	No
KCS Monitor (if start/stop of KCS service is used)	Yes
KCS License-Tool	No
KCS Server configuration tools (WCONFIG, IpPrinter, TWS, FoIP Configuration tool)	Yes
KCS Server processes (see details below)	Yes

KCS server processes require administrative permissions at least for the following known reasons:

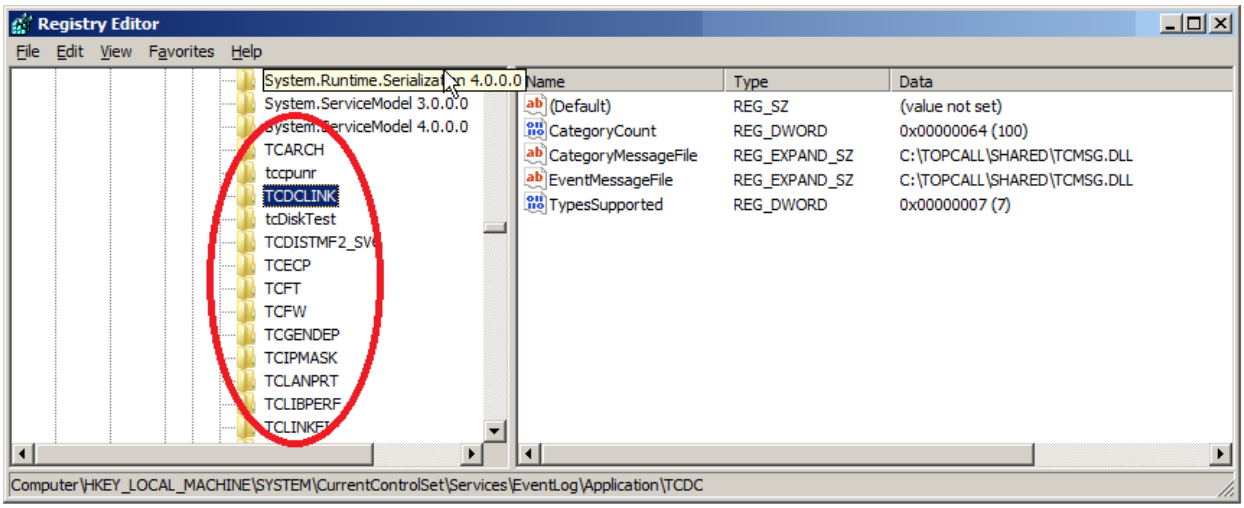
- Write access is required at least for the following none-user specific locations:
  - All trace file locations: C:\tcoss\trace, C:\topcall\foip\??\trace, C:\topcall\tws\??\trace, C:\topcall\ipprinter\??\trace
  - TCOSS file structure file: default location is C:\tcoss\data
- Registry values below HKLM\Software\TOPCALL are written at least in the following cases:
  - If the append trace feature is used the actual trace file number is stored in registry value TraceFileNumber
  - If passwords are changed they are encrypted be the server process.
  - Most server applications create registry values with default values.
  - TC/Archive must be able to reset the registry value TCShortTermArchiveLost after it is manually set in some exceptional cases (E.g. TCOSS server is replaced)
  - Some server processes (for example TCOSS) writes the cause of unexpected termination to registry for troubleshooting
  - KCS Service (TCSRV) writes to registry value HKLM\Software\Topcall\Boot\ProcessReady.
- KCS Performance counters use a global shared memory object, but “Local Policies | User rights Assignements | Create global objects” is by default not granted to members of the users group. If this user right is missing, event log entries with id 15503 “Init Mappping: CreateFileMapping failed (5)” are generated during process startup and KCS performance counters are not available.
- The Messages DLL (tcmsg.dll) is registered in the Windows System (registry values are added below HKLM\ SYSTEM\CurrentControlSet\Services\EventLog\Application) when server applications generate an event log entry. If this registration fails, event logs are viewed as “The description for Event ID xxx from source yyyy cannot be found. …” instead of messages from tcmsg.dll.

KCS Server processes are neither validated nor supported for operation without administrative permissions so that further issues should be expected if administrative permissions are missing!

4.8 Uninstall KCS

Perform the following steps to uninstall Kofax Communication Server:

1. Remove all the Kofax Communication Server applications which you have installed from **Start > Control Panel > Add/Remove Programs** such as TCfW, Kofax Communication Server - Clients Applications, Kofax Document converter and so forth.
2. Each installed KCS application generates a registry key under HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\EventLog\Application. Remove all the relevant registry Keys as shown in the screen shot below.



3. Remove the following folders:

   - C:\MT
   - C:\TCOSS
   - C:\TOPCALL
   - C:\Program Files (x86)\TOPCALL
   - C:\Users\<User Name>\TOPCALL

4. Remove the file “KOFAX_KCS_SETUP.txt” file from **C:**.

5. Remove the following registry keys:

   a. HKEY_LOCAL_MACHINE\SOFTWARE\Wow6432Node\TOPCALL
   b. HKEY_CURRENT_USER\Software\TOPCALL

6. Remove Kofax Communication Server folder from **Start > All Programs**.

5. KCS in Virtual Environment

5.1 Overview on Virtualization

Nowadays in the IT business there is a strong trend called virtualization. It means that applications are moved from a couple of physical, often underutilized servers towards virtual environments running on a single or a few very powerful servers (hosts) that may host a couple of virtual machines, in the context of which different (guest) operation systems (OS) may be running. Simply put, the virtualization creates the illusion for the guest OS and applications that they are running on the dedicated physical machine.

The virtualization is often being implemented due to IT infrastructure consolidation and simplification (a few fully utilized server resources, easily administrable instead of many physical servers, eventually running different OS …).

There are several products in the market providing such a virtualization, e.g., VMware ESX Server, XENSource, and Microsoft Hyper-V.

VMware ESX Server seems to be the market leader in the virtualization; therefore, there is also a strong need to support Kofax Communication Server (platform) product line on this platform. This chapter focuses on ESX server platform 3.x; however, certain sections are relevant for other virtual systems as well.

Note: VMware Workstation, VMware Player, and VMware Server (formerly called VMware GSX Server) are NOT supported

Virtualization of IT infrastructure typically occurs in three steps:

1. Planning

   During this phase performance data for current (physical) environment are being collected for a longer period of time (e.g., 2 weeks) and suitable candidates for the virtualization are being chosen. This step is necessary as no application vendor would be able to provide exact performance data/resource utilization for the specific use case on the particular customer site.

   While in the theory the most of applications can be virtualized, it makes obviously no sense to virtualize applications with high resource utilization (80% and more) of CPU, memory, disk and/or network in the physical environment. Furthermore, in order to reach high virtualization ratio (number of applications virtualized on one ESX host) administrators would attempt to combine applications with different type of workloads on the same ESX server: for example Microsoft Exchange that peaks between 9 and 10 am and 12-13 pm may be efficiently virtualized together with a web server peaking between 10 am and 12 am on the same ESX server etc.

   Having collected the performance data administrator makes a plan which application to be virtualized on which ESX host having in mind that the sum of their specific resource needs (e.g., disk) must not exceed the capacity of the particular ESX server.

There are many professional tools available today to help customers to collect performance and workload characteristics of the applications to be virtualized. For example, VMware offers its Capacity Planner service through their partners to help customers understand their virtualization opportunities. The Capacity Planner's performance data collector runs on local machine on the customer site and it sends the collected data to VMware's data warehouse for aggregation, analysis, and comparison with other systems. After the data collection has been finished, VMware recommends the most effective virtualization approach.

2. Deployment

   Applications that had been chosen as suitable for virtualization are being migrated to the ESX server

3. Operation

   Run virtualized applications on the ESX host, monitor the overall ESX host resources utilization with an appropriate tool (e.g., VMware Virtual Server, Vizioncore's EsxCharter) in order to see whether the machine is not being totally over-utilized. On the other hand, collect the end user experience concerning response times of the virtualized servers, etc. If the performance seems to degrade at particular periods during a day, more resources that appear to be a bottleneck due to overall performance data must be added (e.g., physical network cards or more CPUs). Furthermore, applications that peak at the same periods of time should be split to different ESX servers to make the virtualization more effective.

5.2 Virtualization Planning

5.2.1 Application Categorization

There are two main application categories of the KCS platform family:

1. Real-time

   The applications providing any line connectivity (fax, voice) are being considered real-time due to the real-time characteristics of the fax and voice line transmission: The application must handle the line transmission/reception always in time, and any resource lack may lead to data loss, fax interruption, etc.

   Applications falling into this category are: TCOSS, FoIP and all applications of the Voice Server family – TC/VoiceAccess, VoiceLink2, VoiceXML.

   This is why the virtualization of these applications is the most problematic. The only way to prevent line transmission problems or even data loss is to grant particular resources on the ESX server for them.

   Therefore, KCS specifies minimum resource requirements and offers methods to verify their fulfillment during the operation.

2. Non-real time

   Any other of the accompanying applications (TC/Web, TC/Report, IPPrinter, …) are not dealing with real-time data, therefore, the performance degradation of their VM does not have such a critical impact on their operation. If, for example, the VM with the IPPrinter does not receive enough resources (because they are required for other VMs), the throughput of the IPPrinter would decrease, it would simply print fewer fax pages in a given period of time, but no data loss or interruption would occur.

If such an event occurs, the system administrator should allocate more resources to the particular VM and the problem would be solved. It is the role of the administrator to observe virtualized servers and tune them for optimal performance.

KCS does not prescribe exact resource requirements for non real-time applications.

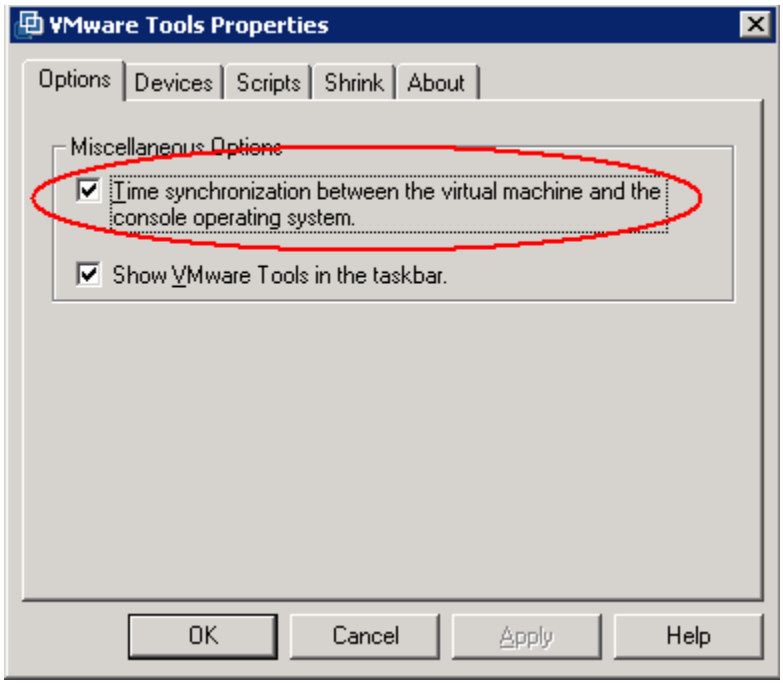
5.2.2 Requirements

VMware Requirements

1.) The supported virtualization platform is the VMware ESX Server 3.01 or later

2.) The supported guest operating system is Windows Server 2008 and later.

3.) VMware Tools must be installed on the guest operation system with time synchronization option:



Real-Time Applications

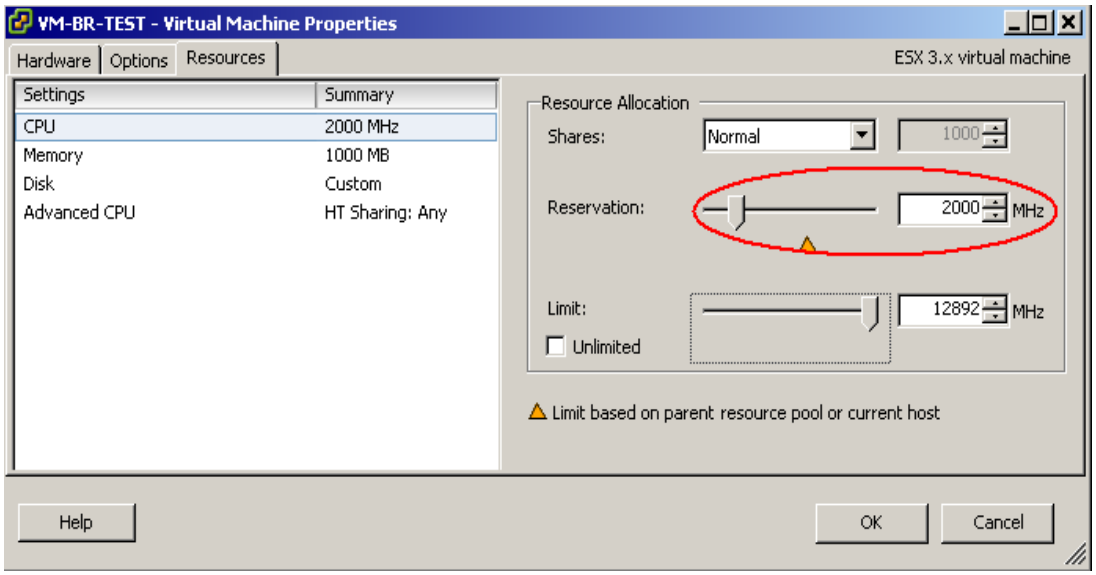
1.) TCOSS (single or even multiple instances) must be installed on a dedicated VM; in the case of tandem server both VMs must be located on two different ESX servers

3.) Up to 10 TCOSS Storage instances with 1 Media Server instance are supported on one VM

4.) Following resources must be explicitly granted by the ESX server to the VM according to the Resource estimation table (in the case of a new customer, refer to the chapter Resources estimation for new customers) or measured performance data of a real system (existing customers):

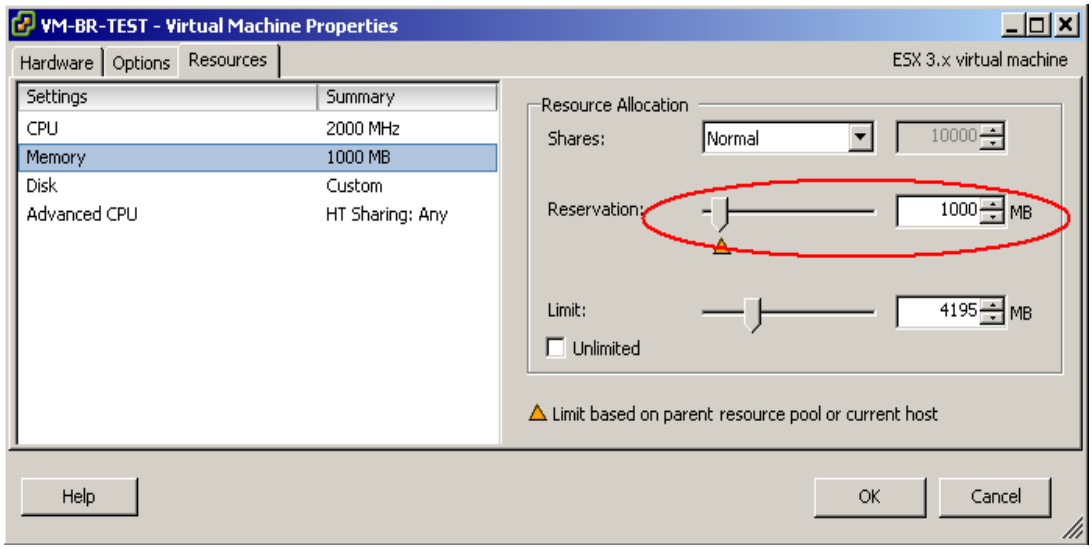
a.) Minimum CPU bandwidth (MHz)

Can be accomplished by the ESX VI client, refer to the following example:



b.) Minimum RAM in MByte

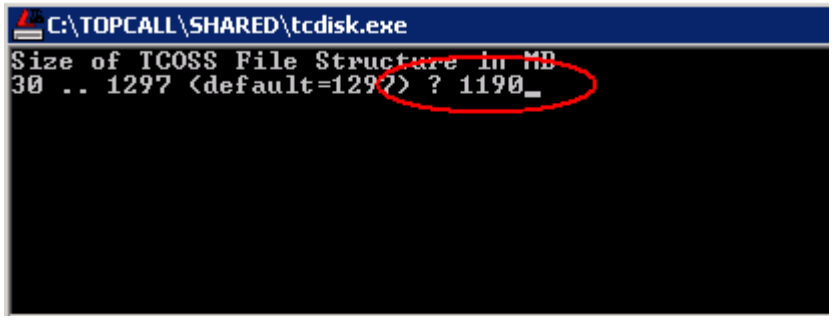
Can be accomplished by the ESX VI client, refer to the following example:



5.) TCOSS file structure must be stored on the dedicated SAN VMFS volume (in order to minimize high contention operation while sharing the same volume with a lot of other VMs).

6.) Keep at least 100MByte free room on the VMFS volume (dedicated for the TCOSS file structure)

(During the formatting of the TCOSS File structure, enter the size in MByte that is by ca. 100 lower than indicated default value):



The reason for doing so is to be able to test the disk access to this volume using the dedicated TcDiskTest tool.

If this recommendation is not fulfilled, it will be not possible to test actual disk throughput with the dedicated TcDisktest tool afterwards

7.) 1 virtual CPU (VCPU) should be used.

8.) All other KCS applications connecting to the TCOSS must be run in separate VM(s). It is recommended to connect their VNICs (virtual network adapters) to the same vswitch (virtual switch) as the VM of TCOSS.

9.) In the case of multi-TCOSS instance operation (ASP model), all TCOSS instances may run in the single VM. In this way storage TCOSS instances communicate with the media server through internal vswitch and not over the physical wires.

10.) The TC/PerfLog application must be installed along with KCS setup on the TCOSS and FoIP server) in order to permanently collect key performance indicators as Windows performance counter log files. See TC/PerfLog Technical Manual for information about the application.

Non Real-Time Applications

No special requirements.

5.2.3 Resources Estimation for New Customers

In the case of a new customer who would like to deploy the KCS platform directly in their virtualized environment (without the possibility to measure the real resource needs of their physical servers), refer to the chapter Resource Estimation and Key Performance Indicators to find initial resource estimates to start deployment with.

Later, during the operation of the KCS platform, it is required to observe the actual resource utilization. If the utilization of a particular resource is higher than planned, grant more resources (in the case of CPU or RAM) and/or – in the case of disk or network utilization – inform system administrators on increased utilization so that they could match the new increased requirements with the overall resources distribution on the particular ESX server.

Refer to the chapter Resources Estimation for Existing Customers for the guide how to measure real resource needs.

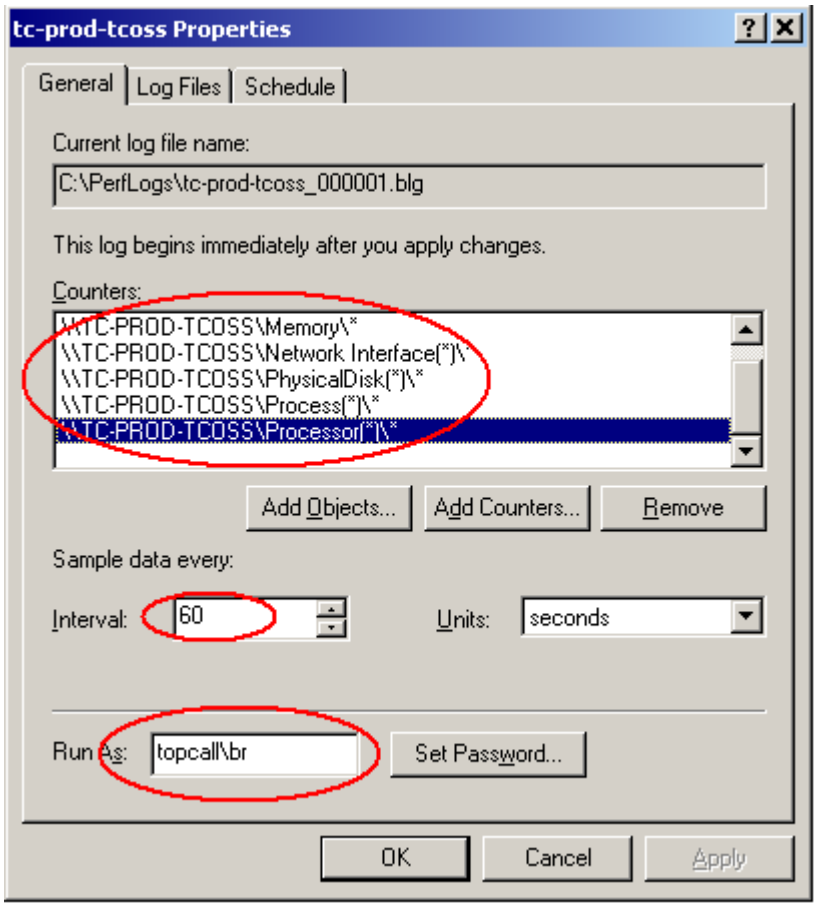
5.2.4 Resources Estimation for Existing Customers

During the virtualization planning, the existing customers would usually use any of specialized capacity planning tools (Platespin PowerRecon, VMware Capacity Planner, …) to collect performance data of their physical servers (the usage of them is out of scope of this document) and then plan the deployment of their virtual infrastructure. If this is not the case, the same task can be also accomplished simply by collecting performance data for the typical workload for the particular application for a longer time (1-2 weeks) by the Windows performance monitor. It is even possible to collect minimum requirements also if running the particular application already in the VM. However, in this case the consumed processor utilization should be measured via the Virtual Infrastructure client in processor bandwidth expressed in MHz.

During this process, the following most important resource requirements should be collected:

1. Processor utilization (%)
2. Memory usage
3. Disk throughput (kBytes/sec, IOPS)
4. Network throughput (kBytes/sec)

If the performance data should be collected by the Windows Performance Monitor, start it locally or on any other Windows computer in the network (in latter case you will have to specify an appropriate user with admin rights on the computer being monitored) and setup logging for following performance objects:



Double-check whether disk performance counters have been activated (they are not active by default) by command

```
Diskperf -Y <Enter>
```

After the measurement has been finished, consider especially following counters:

1. a.) Number of processors (n)

   b.) Processor(s) total utilization in % (u)
   along with information on CPU model and frequency (f) (e.g., Pentium IV 1500MHz)

   c.) Processor(s) bandwidth in MHz (if already running in the VM)

   Evaluation: Calculate estimated CPU bandwidth in MHz for the ESX server based on processor utilization u in % on the physical system:

```
CPUMHz = (n * f * u)/100
```

In the case of real-time applications this is the minimum CPU bandwidth that must be granted for the particular VM

Example: Total processor utilization u=50% on dual-PIV 1500MHz processor (f=1500) corresponds with

```
CPUMHz = (2 * 1500 * 50)/100 = 1500MHz
```

2. Memory Committed Bytes

   Evaluation: Determines the memory (RAM) demand.

   In the case of real-time applications this is the minimum amount of RAM memory that must be granted for the particular VM

3. Physical disk Transfers/Sec (IO per second = IOPS)

   Physical disk Bytes/Sec

   Network Bytes Total/Sec

   Evaluation: Disk and network requirements must taken into account by the system administrator during the planning phase of the particular ESX server

After the performance data of all P2V (physical to virtual) candidates have been collected, administrators will make a plan how to combine different applications and their workloads on the particular ESX server(s).

However, availability of the planned resources must be checked during the server operation, refer to the chapter KCS Platform Virtualized Operation.

5.2.5 Resource Estimation and Key Performance Indicators

TCOSS Server

This chapter provides resource requirements of the ESX Server resources (CPU, RAM, Disk and Network) for a typical TCOSS Tandem Fax Server fully utilizing particular number of fax channels (e.g. 20, 40, 60) using the following scenario:

1. TC/Link-FI (running in the separate VM) is sending 2 page image documents (ca. 100kByte TCI code)
2. Received documents are being sent via the half number of available fax channels and received via the same number of channels (2 LS1V2 servers connected through loop PRI cable)
   (Standard TCOSS UIF configuration with backreception activated, TCOSS Tandem Server configured with 2 LS1V2 servers with 30 fax channels each, both LS1V2 servers connected through loop PRI cable)
3. All received documents are fetched and printed by the IPPrinter (running in the separate VM) to the Windows printer server

Following resource estimation and key performance indicators table consists of three parts:

1. Required granted resources are those that must be permanently allocated on the ESX Server for the TCOSS VM. The ESX Server itself guarantees that these resources are available
2. Resource capacity to be planned must be taken into account during the virtualization planning phase by the system administrators. Note that it is planning stuff only and availability of these resources cannot be explicitly checked, only indirectly by observing key performance indicators.

3. Key performance indicators are values that must be fulfilled and measured during the operation in order to check whether planned resources (see point 2. above) are really available. Refer to the chapter Virtualized Operation.

Resources Estimation and Key Performance Indicators for TCOSS Tandem Server						
Load channels [x] / throughput in fax pages / minute	20 40 fax pages / min		40 80 fax pages / min		60 120 fax pages / min	
Primary / secondary master metrics	P	S	P	S	P	S
Required granted resources on the ESX server:						
CPU [MHz]	1300	1300	1400	1400	1500	1500
RAM [MByte](1)	512	512	512	512	512	512
Resource capacity to be planned on the ESX server:						
Average TCOSS Disk kBytes/s	50	50	100	100	150	150
Average TCOSS Disk IOPS/s	12	12	24	24	36	36
Average Network kBytes/s (2)	150	50	250	100	350	250
Network bandwidth [Mbit/s] (2)	10	10	10	10	10	10
Key performance indicators that must be measured and fulfilled for the proper operation:						
Average RTT_{ls1}[ms]	<100	<100	<100	<100	<100	<100
Peak RTT_{ls1}[ms]	<1000	<1000	<1000	<1000	<1000	<1000
Average $RTT_{prim\text{-}sec}$ [ms]	<10	<10	<10	<10	<10	<10
Peak $RTT_{prim\text{-}sec}$ [ms]	<500	<500	<500	<500	<500	<500
Average $RTT_{storage\text{-}media}$ [ms]	<10	<10	<10	<10	<10	<10
Peak $RTT_{storage\text{-}media}$ [ms]	<500	<500	<500	<500	<500	<500
Average Write Disk Latency [ms] (3)	<20	<20	<20	<20	<20	<20
Peak Write Disk latency [ms] (3)	<2000	<2000	<2000	<2000	<2000	<2000

(1) Add 128 MByte RAM for each additional TCOSS storage or media server instance

Used abbreviations	Explanation	Performance Object	Performance Counter	Instance Name
RTT_{ls1} RTT_{FoIP}	Round-trip-time between TCOSS and LS1 servers/ FoIP Servers	TCOSS Links	Avg. Packet-Ack Time ms Peak Packet-Ack Time ms	L.XY
$RTT_{prim\text{-}sec}$	Round-trip-time between primary and secondary Master (that occurs during the remote-disk access)	TCOSS Links	Avg. remote Disk Network Delay ms Peak remote Disk Network Delay ms	None
$RTT_{storage\text{-}media}$	Round-trip-time between Storage and Media Servers (in the case of ASP system)	TCOSS Links	Avg. Round Trip Time ms Peak Round Trip Time ms	0, 1, 2, or 3
Average Write Disk Latency [ms]] (1)	Average duration of a write disk access in ms	TCOSS Disk	Avg. local Disk ms/Write Avg. remote Disk ms/Write	None
Peak Write Disk Latency [ms] (1)	Peak duration of a write disk access in ms	TCOSS Disk	Peak local Disk ms/Write Peak remote Disk ms/Write	None

(2) Average Network kBytes/s is the real bandwidth consumption, the Network bandwidth is the recommended capacity to be planned for the TCOSS server

(3) This indicator stands for both local and remote disk latencies if Tandem Server is being used.

Mapping among key performance indicators and corresponding Windows performance counters

(1) The remote disk write counters include a sum of as network latency between primary and secondary master and the disk access time itself.

Average counters (“Avg.”) indicate the average of the particular value between two subsequent performance monitor measures.

Peak counters (“Peak”) indicate the peak value between two subsequent performance monitor measures.

After the deployment has been already done, it is necessary to continue observing the actually used resources of the particular TCOSS Server configuration and adapt the resources allocation if necessary. Please refer to the chapter Virtualized Operation.

IPPrinter

This chapter provides resource estimation of the ESX Server resources (CPU, RAM, Disk and Network) for a typical IPPrinter VM printing received 2-page faxes (ca. 100kByte TCI code) via particular number of fax channels (e.g. 10, 20, 30).

Note that this is planning stuff only, no granted resources are required. However, the IPPrinter is very CPU-bound (causes high CPU utilization) and that is why its operation must be carefully observed while running in the virtualized environment. If any problem would be noticed (e.g. incoming faxes being printer with a long delay after being received) it may indicate that IPPrinter would not get enough CPU resources. In such a case necessary CPU bandwidth should be granted for the IPPrinter VM (based on estimated in the table below or even more if necessary).

Resources Estimation and Key Performance Indicators for IPPrinter						
Receiving fax channels [x]/ Printouts in fax pages / minute IPPrinterMetrics	10 20 fax pages / min		20 40 fax pages / min		30 60 fax pages / min	
Resource capacity to be planned on the ESX server:						
CPU [MHz]	1000		1200		1400	
RAM [MByte](1)	1024		1024		1024	
Average IPPrinter disk kBytes/s	100		125		150	
Average IPPrinter disk IOPS/s	22		24		28	
Average network kBytes/s	70		90		110	
Key performance indicators that must be measured and fulfilled for the proper operation:						
none						

(1) If more than 1 IPPrinter instance is being used 2048 MByte RAM should be planned

5.3 Virtualization Deployment

This chapter provides a short overview on different possibilities how to deal with system resources on the ESX host.

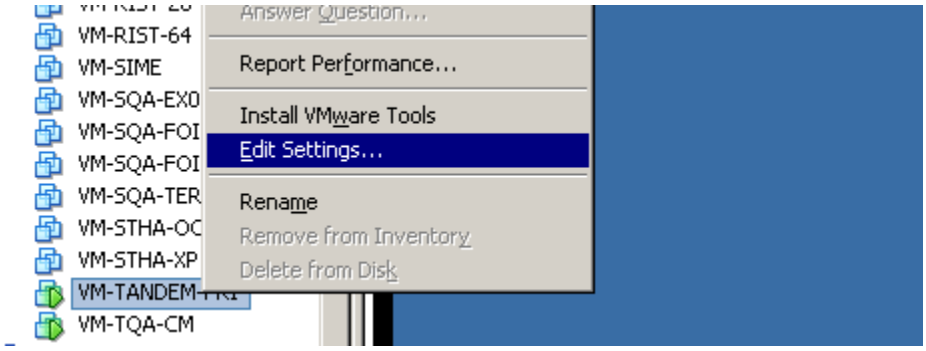
5.3.1 CPU

The ESX server handles the CPU resources in terms of “MHz bandwidth” by simply adding the MHz CPU cycles of all available CPUs together (e.g. having 4 dual-core 3.6 GHz CPUs in the ESX server would give total CPU bandwidth of 4x2x3600=28800MHz). There are two possibilities how to allocate this CPU bandwidth to the particular VM:

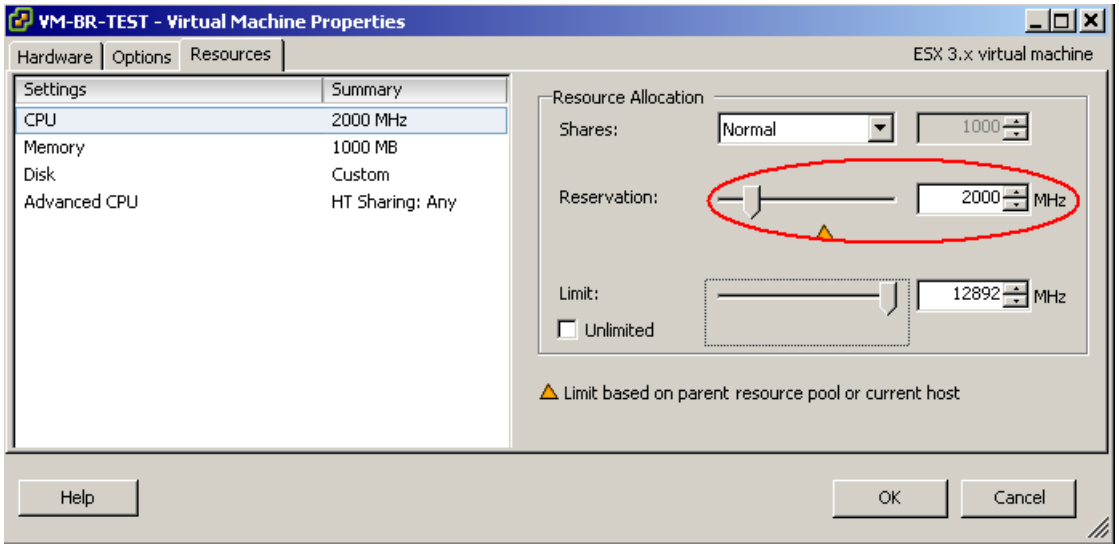
1) The shares method (fair share principle)
   This method is clearly most effective method for the system administrators, guaranteeing the most effective utilization of resources on the ESX server. On the other hand, when the administrators add more and more VMs to the ESX server, this decreases the CPU resources also for the other VMs and therefore it is not suitable for real-time applications like TCOSS Server, but may be used for other KCS applications like IPPrinter.

2) Explicitly grant minimum CPU bandwidth (in MHz)
   The particular VM always receives the minimum amount of CPU cycles despite of the fact whether it needs them or not – therefore this method is not being favored by the VMware, but it is a clear precondition for the VM running real-time application. If the necessary resources could not be granted, the ESX server simply does not start particular VM. Furthermore, due to the Timekeeping issue in the virtualized environment (see http://www.vmware.com/pdf/vmware_timekeeping.pdf) it is absolutely necessary for the messaging server to receive enough CPU cycles in order to keep its time synchronized with the real-time (especially important for the messaging servers due to legacy reasons).
   Note that this method is required for KCS real-time applications (TCOSS Server).

The CPU for the particular VM may be allocated by the context menu “Edit Settings” via the VI client:

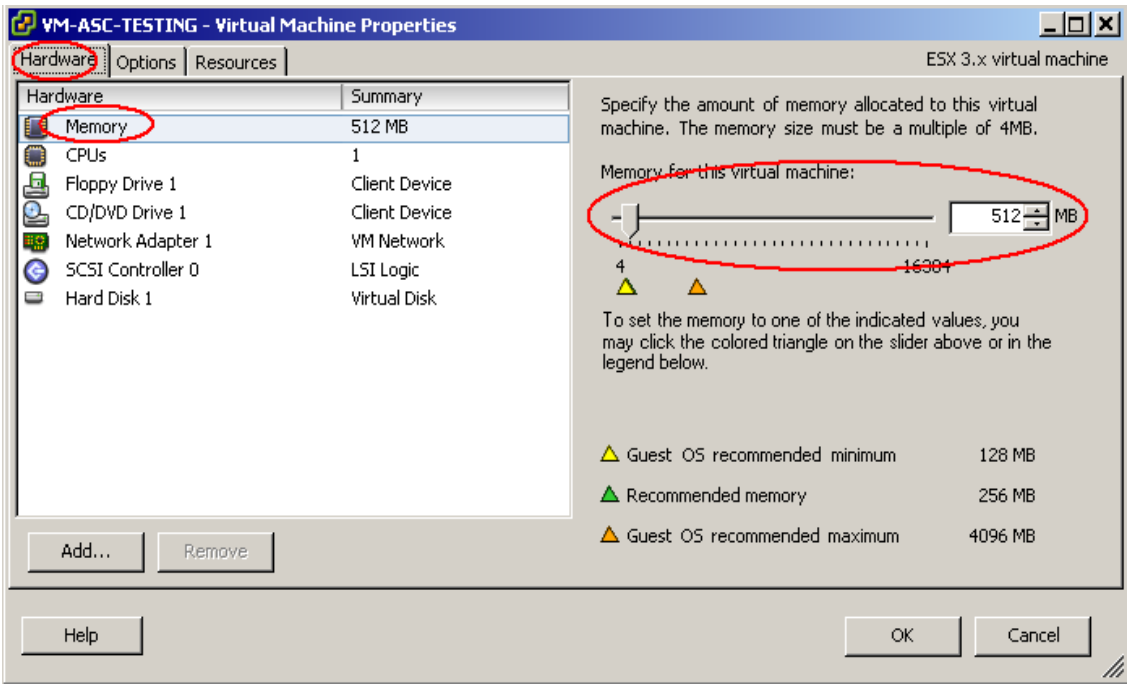


In the panel Resources of the Virtual machine Properties dialog:

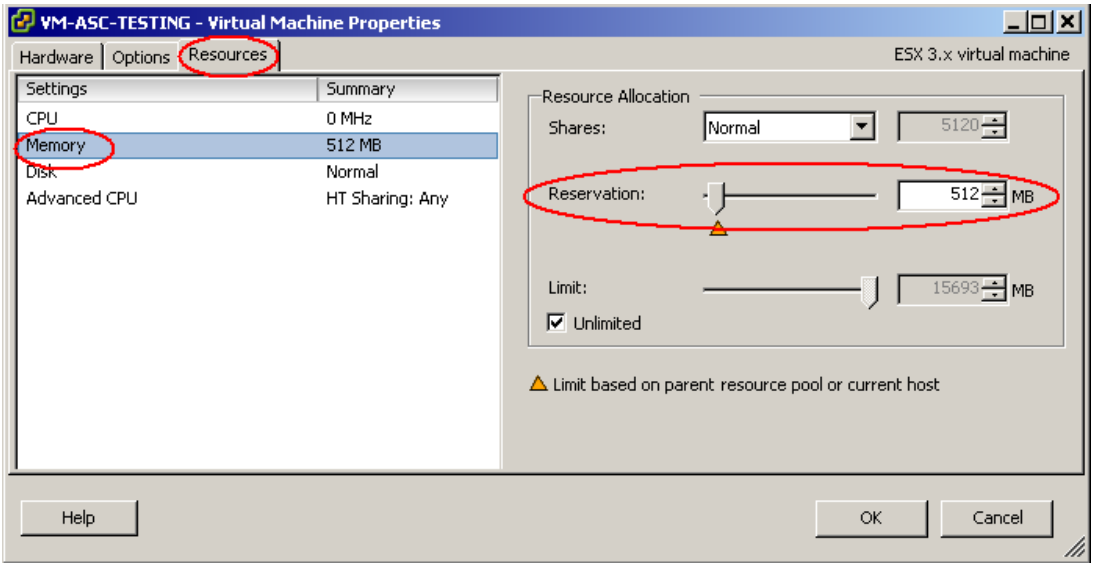


5.3.2 Memory

Amount of the memory allocated for the particular VM can be configured via the Hardware panel of the Virtual machine Properties (configured memory can be changed only if the VM is powered off):



Granted Memory resource (memory reservation) can be allocated using the shares method or explicitly grant enough memory for the VM in the Resources panel:



The configured RAM in the hardware panel is the amount of memory allocated for the particular VM by the ESX server, but not granted to it exclusively (it could be e.g. shared with the other VMs). Memory exclusively granted to the VM is specified in the Resources panel (as memory reservation).

If granting of specific amount of memory is required (for KCS real-time applications), set both Memory values in Hardware and Resources panels to the same desired value (e.g. 512 MByte).

Note than it makes no sense to set memory reservation (Resource panel) higher than configured memory (hardware panel) as in such a case ESX server would restrict the reserved memory to the amount of configured memory.

Background information:

One of the main reasons for having two distinct RAM setting for the VM is the swap file size estimation for the particular VM, consider examples:

1. If configured memory (Hardware panel) equals to 512 MByte, but reserved memory equals 0, then the size of the swap file would be 512 MByte
2. If configured memory (Hardware panel) equals to 512 MByte and reserved memory equals to 256 MByte, then the size of the swap file would be 512MByte – 256MByte = 256 MByte as the ESX server would potentially need to swap only 256 MByte of allocated RAM as 256 MByte is granted to be always available for the VM
3. If configured memory (Hardware panel) equals to 512 MByte and reserved memory equals to 0 MByte, then the size of the swap file would be 512MByte – 512MByte = 0 MByte as the ESX server wouldn't need to swap anything as the whole RAM is granted for the VM.

Note that granting enough memory is required for KCS real-time applications (TCOSS Server).

5.3.3 Disk

It is not possible to explicitly allocate minimum disk bandwidth for the VM under the ESX server. Furthermore, there will be typically no local hard disks connected to the ESX server. Instead, one of the network storage systems will be used (SAN, NFS, NAS).

Typically, network storage arrays (SANs) are divided into logical units (LUN), and each LUN may be partitioned into several partitions. The ESX server uses following storage addressing scheme:

```
<HBAx>:<SCSI target>:<SCSI LUN>:[<disk partition>] (disk partition is optional)
```

For example, vmhba1:0:0:1, which means host bus adapter 1, SCSI target 0, LUN=0, partition 1:

Storage Refresh Re

Identification	Device	Capacity	Free	Type
Datastore_0	vmhba1:0:2:1	678,50 GB	557,68 GB	vmfs3
Datastore_1	vmhba1:0:0:1	1,99 TB	358,98 GB	vmfs3
Datastore_2	vmhba1:0:1:1	1,55 TB	1,29 TB	vmfs3

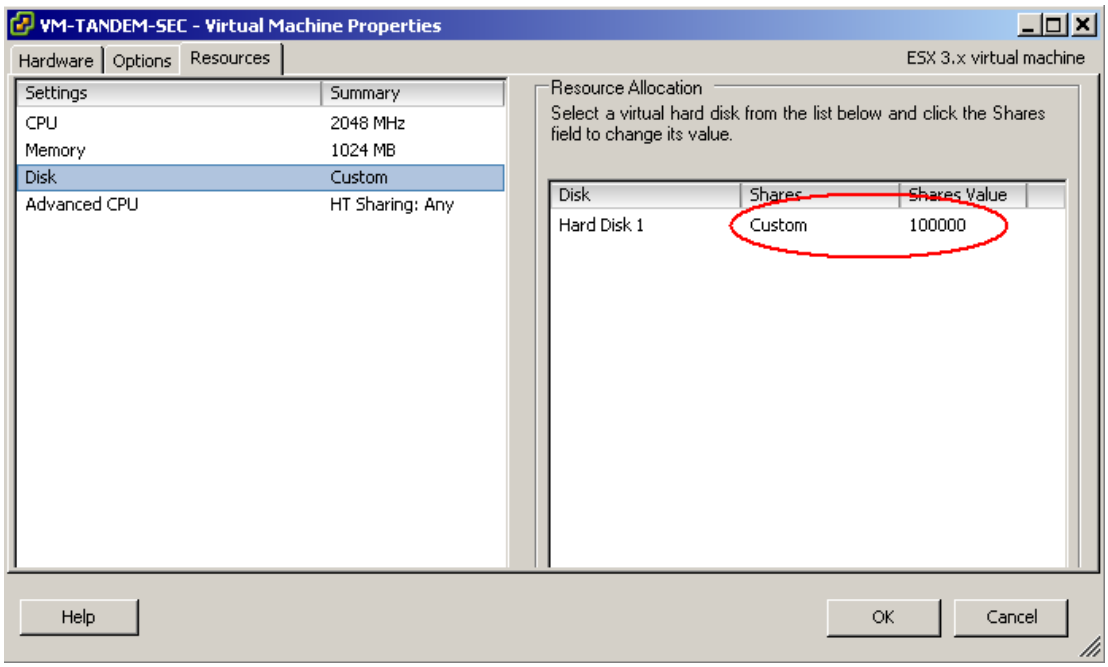
VMware uses its own file system called VMFS where all VMs are stored in terms of .vmdk files.

Per LUN/partition only one VMFS volume is allowed, but on the other hand, one VMFS volume may span over several LUNs/partitions. Administrators may use fewer, larger VMFS volumes, but also more but smaller VMFS volumes.

One advantage of using smaller VMFS volumes is higher throughput for the particular VM due to less contention on each VMFS volume due to locking and SCSI reservation issues. Also the disk shared reservation policy works per LUNs, so it seems to be reasonable to request a dedicated LUN with a VMFS volume for TCOSS file structure

(VMware recommends in the storage best practices guide, that heavily used VMs do not access the same VMFS concurrently and that they are spread across multiple VMFS volumes).

Consider also the possibility to use the shares method (similar as with the CPU) to set the relative priority with respect to the other VMs to get the disk bandwidth:

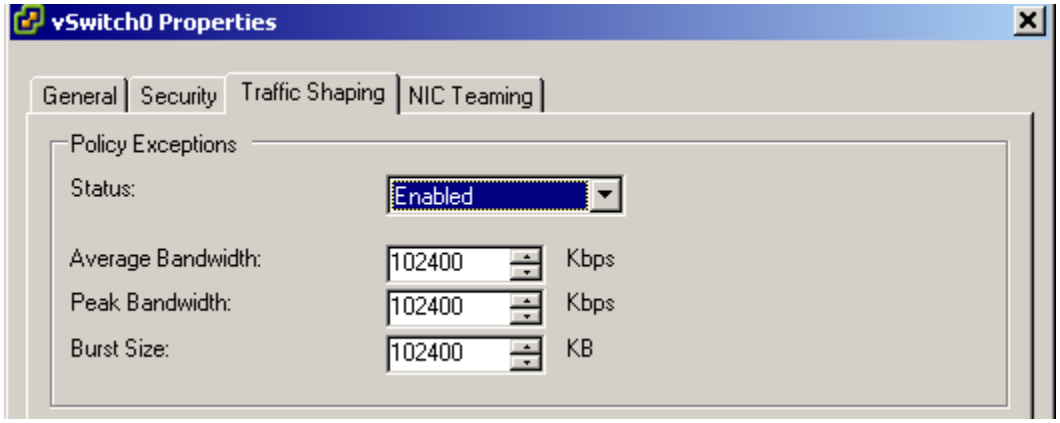


Note that it is recommended for the TCOSS file structure to be allocated on a separate VMFS volume (in order to minimize contention with the other VMs).

5.3.4 Network

Similar to the disk resources, there is no possibility to allocate required network bandwidth for a particular VM.

On the ESX host there is only a possibility to configure so called network traffic shaping, that performs the opposite, i.e., limits network bandwidth at the virtual switch level:



But the experience from the real world shows, that network bandwidth is not a significant factor in ESX server performance since the most large-scale hosts are provided gigabit network connectivity.

Furthermore, also CPU utilization plays a significant role in reaching acceptable network throughput, especially in virtualized environments, where significant part of network connectivity is realized in the software (virtual switches, etc.). Insufficient CPU resources will reduce maximum network throughput and therefore it is important to:

1. Monitor CPU utilization on the ESX host permanently

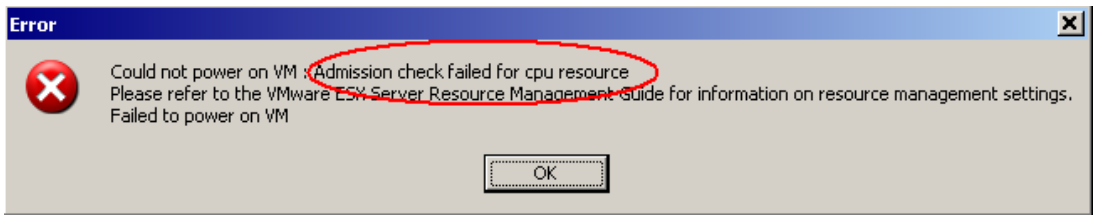
2. Allocate enough CPU bandwidth for the VM kernel

5.4 Virtualized Operation

This chapter provides information how to check the availability of particular resources prior to the and during the operation of the KCS platform on the ESX server.

5.4.1 Checking CPU and Memory Requirements

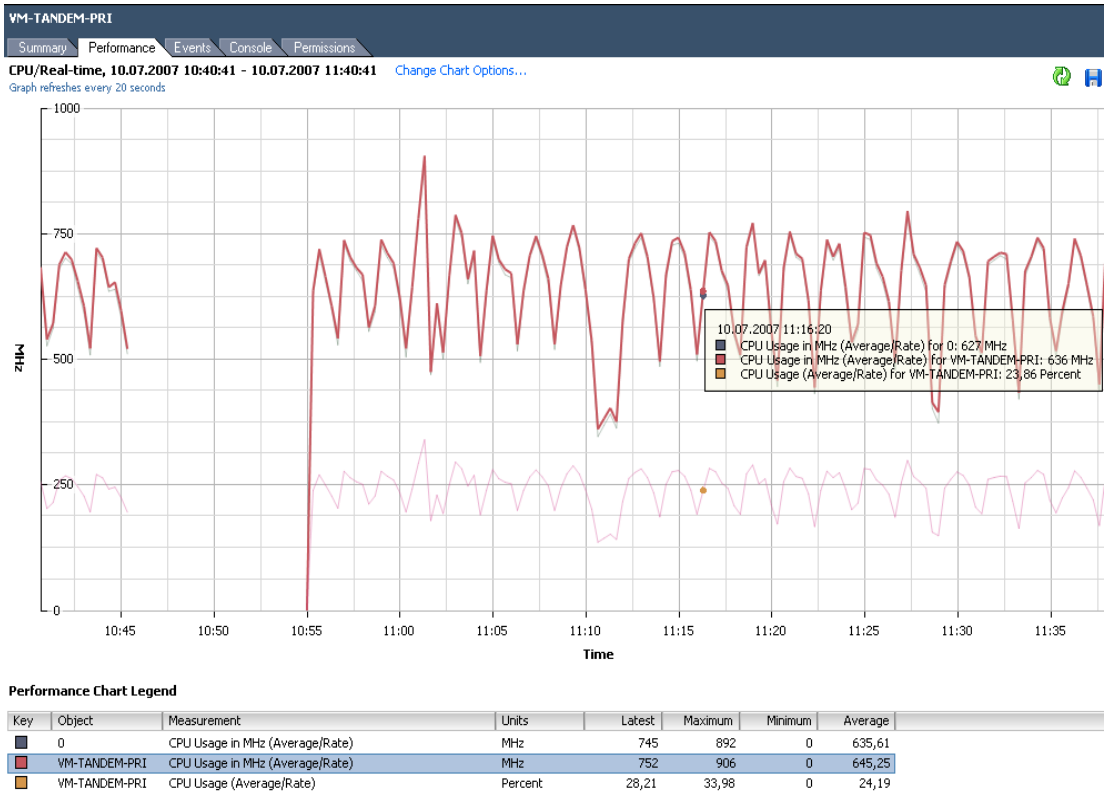
As the requested resources must be granted for the particular VM running real-time applications (e.g. TCOSS Server), the ESX server performs resource availability check during power on of the VM. If the resources cannot be granted (due to over-commitment), ESX server will not start up the VM and displays an error message like the following:



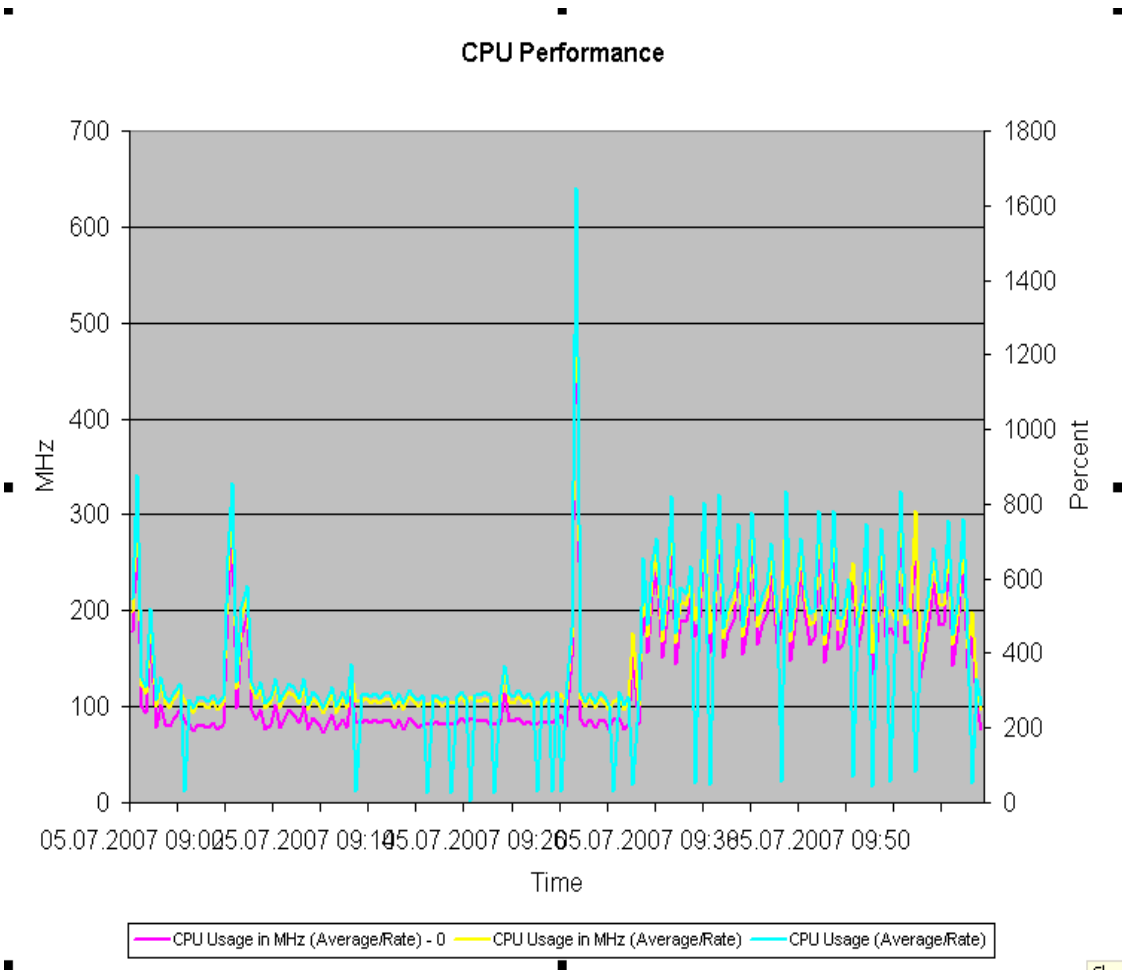
So, in the case of KCS real-time applications (TCOSS Server), the ESX server itself would guarantee that CPU and memory requirements are fulfilled.

On the other hand, for other non-real time applications (e.g. IPPrinter) without any granted CPU/memory resources, following steps may help to identify CPU and/or memory resource problem:

1. Check the CPU usage by the VI client:



or alternatively export the performance data from the VI client to the Excel sheet and consider afterwards:



2. Observe VI's counter CPU ready and CPU wait:

a.) CPU ready is the amount of time in ms (since last performance query – 20 seconds by default) the VM was ready to work but it was not scheduled by the ESX server. In other words, the higher CPU ready value is, the fewer CPU resources the VM gets

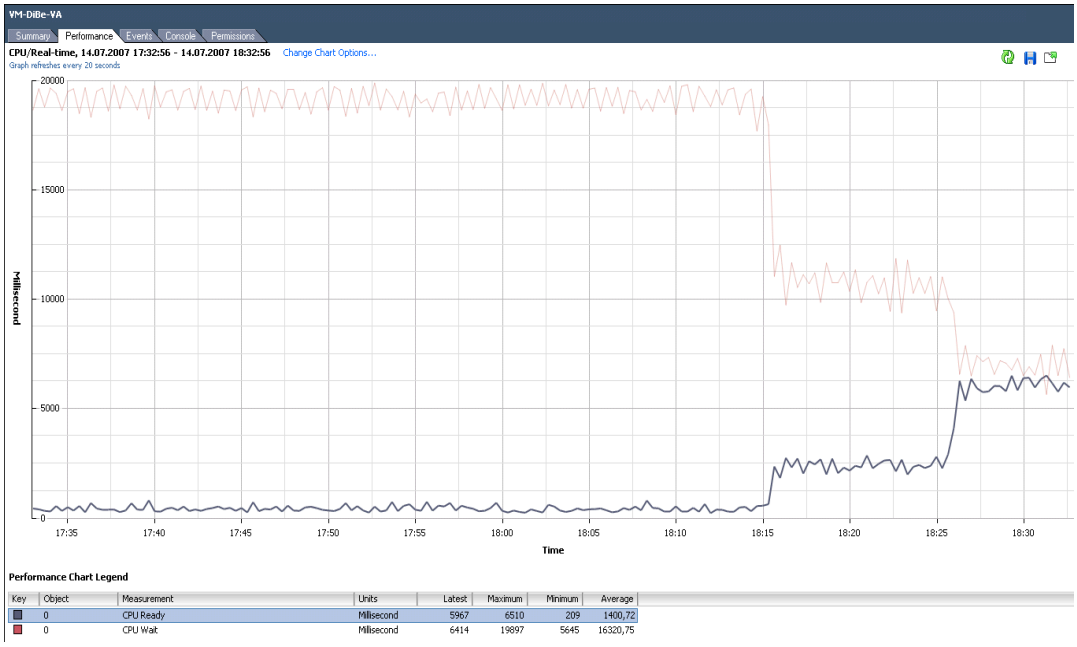
b.) CPU wait is the time in ms the VM was scheduled by the ESX but did not have anything to do. In other words, the higher CPU wait value is, the more CPU resources the VM gets even if it does not need them

The goal is to keep the CPU ready time low, refer to the example below:

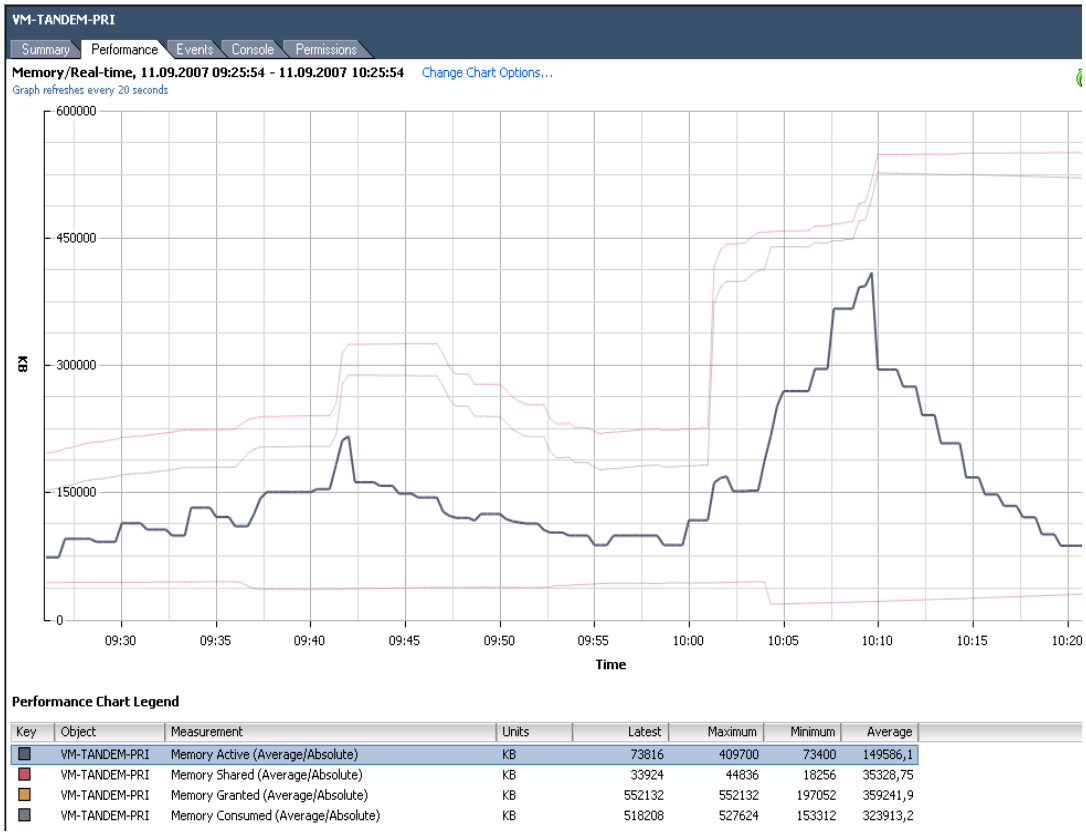
a.) Up to ca. 18:15 the observed VM (with some granted CPU bandwidth) was idle, so the CPU ready time was almost 0 (no activity in the VM) but the CPU wait time was very high (this time was effectively wasted as the CPU time was allocated but no work to do)

b.) At about 18:15 the specific load was started, the CPU ready time increased a little but the CPU wait time decreased substantially (it means that the CPU was used more effectively)

c.) At about 18:25 (during the load) the granted CPU bandwidth was removed from this VM: the CPU wait decreases (the CPU is being used even more effectively), but the drawback is that the CPU ready time increases (the application was more often ready to work but has to wait for the CPU)



3. Start the test workload for an hour and check the Memory granted, Memory consumed and Memory active counters in the VI client (may be also exported as Excel sheet):



Memory granted is the amount of memory that has been reserved for the particular VM by the ESX server. Memory consumed is the memory the VM is really consuming, Memory shared is memory that has been saved due to memory sharing among VMs.

Roughly said, Memory consumed = Memory granted - Memory shared.

Memory active is the amount of memory that the VM is actively using, based on the current VM activity, applications running there etc. (on the other hand, Memory consumed is the memory the VM is “occupying” on the ESX server, despite of the current VM activity).

As a rule of the thumb it can be said that memory active should always be lower than memory consumed for the proper VM’s operation without a lot of RAM swapping.

Further, in the case of real-time applications, check whether the Memory active values are permanently lower than values estimated for RAM in the resource estimation tables.

In the screenshot above, up to about 10:00 o’clock the VM didn’t have any fix RAM reservation, and it can be seen that the ESX server grants dynamically a little more memory than really needed (Memory active counter).

After 10:00, the VM has been assigned about 512 MByte of RAM, and it can been seen that the Memory granted counter remains constantly on this level despite of the amount of memory actively being used.

5.4.2 Checking Disk IO Latency

The disk bandwidth is the most critical resource as the physical disk is typically implemented as some kind of network disk arrays (SAN) and its bandwidth will be shared by all VM running on the particular ESX server.

If the administrators properly calculate disk bandwidth requirements of all involved applications, there should be no problem but often peak requests from other applications may also influence the available disk bandwidth of the KCS platform applications. While this is not a real problem for non real-time applications (may lead to increased end user response times for TC/Web etc.), it may cause substantial problems especially on the TCOSS server like:

1. Interrupted faxes being sent or received
2. Reboots and resynchronization of the secondary master in the case of tandem server operation

Therefore, it is a good idea to verify the disk bandwidth availability even prior to but also continuously during the TCOSS operation to see whether enough disk bandwidth is available.

Using TcDiskTest Tool

TcDiskTest is a simple command-line utility that performs disk write operations in the same manner TCOSS would do. It is easily possible to test the suitability of a particular virtual machine/virtualized environment for the desired TCOSS operation. During the first run the tool creates own test file (named tcDisktest.bin) in the root directory of the disk/partition to be tested, and then performs random write operations of a data block of 4-kBytes (configurable) to this file and exports three performance indicators as Windows performance monitor counters:

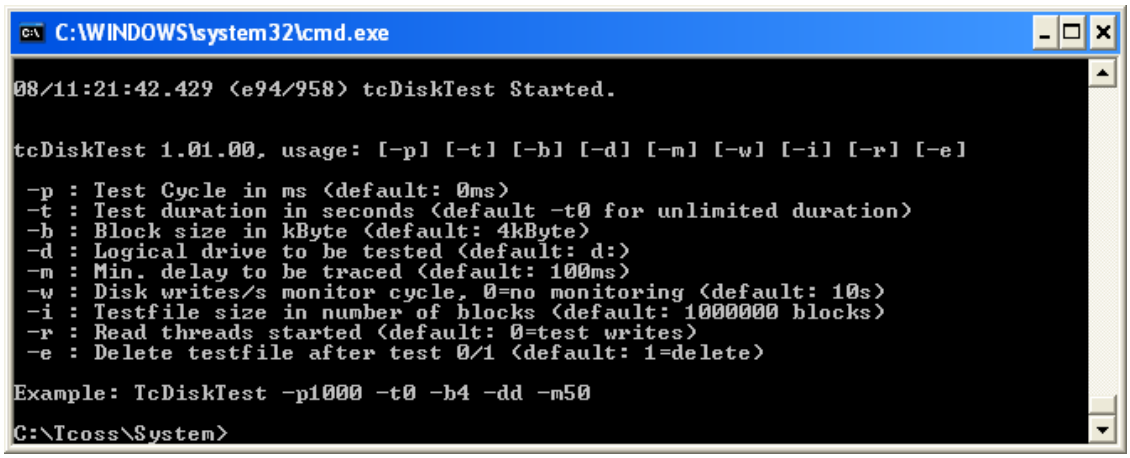
1. Disk ms/Write (Current disk write access latency in ms)
2. Avg.Disk ms/Write (Average disk write access latency in ms)
3. Peak Disk ms/Write (Peak disk write access latency in ms, since last performance monitor sample)

Installation

Copy the TcDiskTest.exe and TClib32.dll to any directory on the TCOSS server (tclib32.dll is only necessary if there has been no KCS installation before, if the TCOSS has already been installed the TCLIB32.DLL is already available there).

Operation

Starting the test tool without any parameters shows a short help:



Parameter explanation:

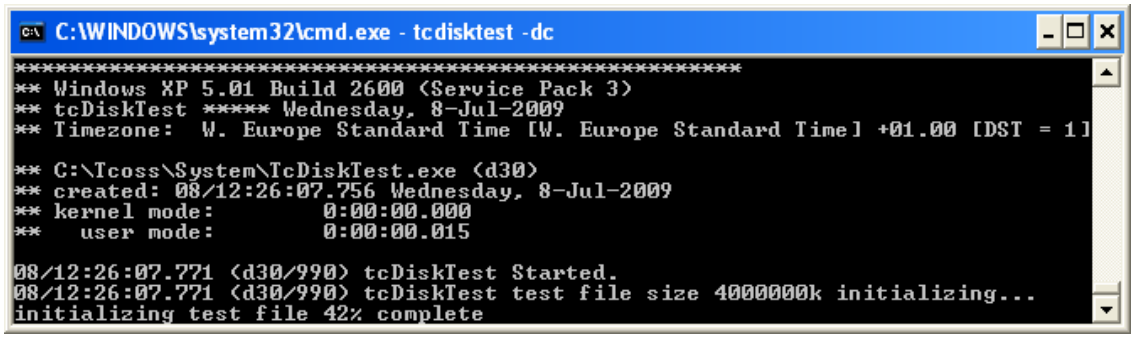
- -pXY: Perform one disk write access in XY milliseconds
- -tXY: Maximum test duration in seconds (-p0 for unlimited test)
- -bXY: The size of block to be written during each disk access in kBytes
- -dX: The logical drive to be tested (e.g. –dc for C:, -dd for D:, etc.)
- -mXY: Show each disc access that lasted longer than XY ms on the screen and in the trace file
- -wXY: Show current and average disk writes/sec every XY seconds
- -iXY: Test file size in number of blocks (default: 1000000 4kByte blocks => 4 GB)
- -rXY: Test disk reads (instead of writes) using XY read threads, 0 = test writes
- -eX: Delete test file after test 0/1 (default 1 = delete)

It is not necessary to change any default settings except for –p, -t and –d parameters.

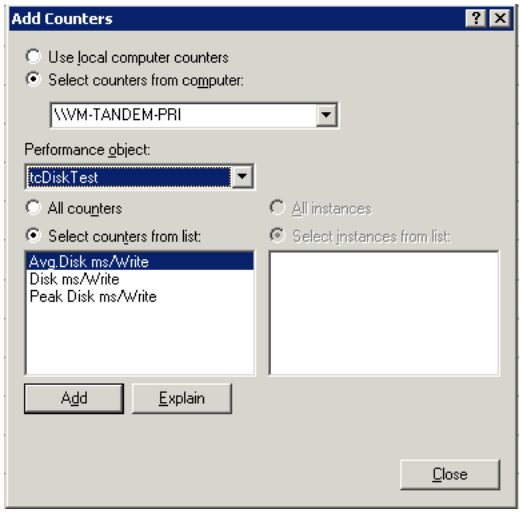
For the test operation at least command –p must be entered. For example, to perform one disk access in 1000ms in the root of the D: logical drive, enter:

```
C:\TcDiskTest> TcDiskTest -p1000 -dd
```

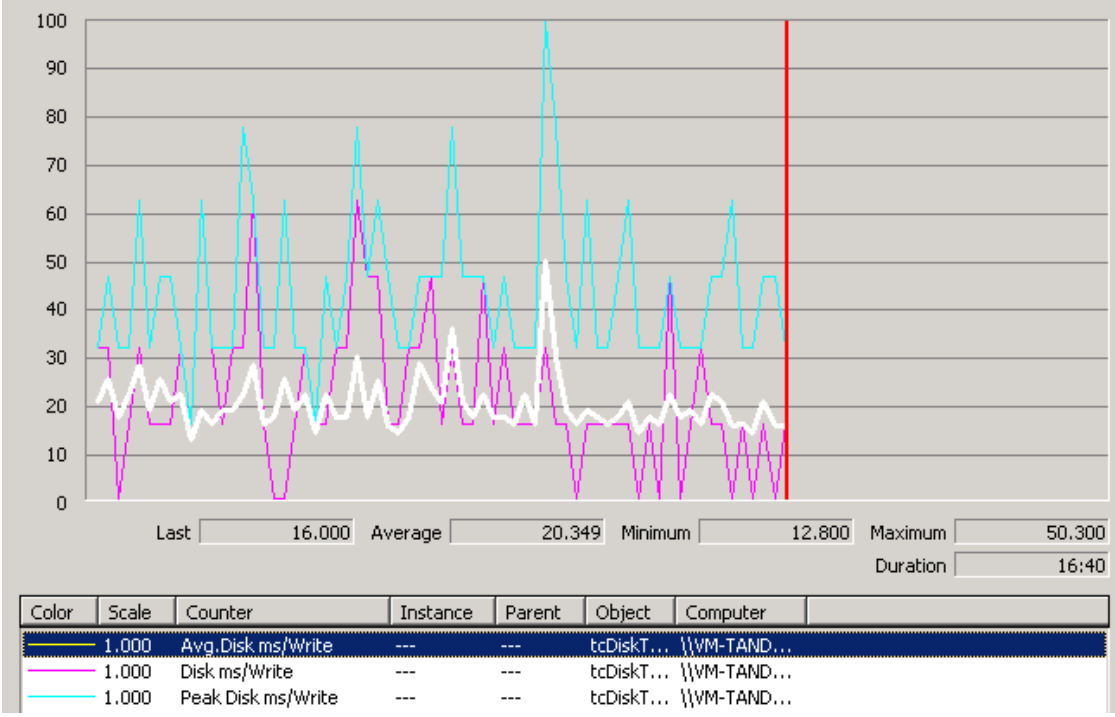
During the first run, the tool at first creates its test file (note that it may take a few minutes to do so):



In order to see the performance counters provided by TcDiskTest, start Windows performance monitor, add performance object “TcDiskTest” and all three counters:



Start collecting these counters for a period of time:



The best indication for the suitability of the particular VM for the TCOSS operation are the Avg. Disk ms/Write and Peak Disk ms/Write counters: their values can be directly compared with average and peak disk write access times in the Key performance indicators table (see chapter Resource Estimation and Key performance Indicators). For example, the measurement shown above would indicate that the VM is not suitable for the TCOSS operation as there are often spikes in the average Disk ms/Write reaching 30-40 ms.

It is also a good idea to let this tool be running for a longer period of time (e.g. 2-3 day or even one week) to detect disk access peaks at specific days/times.

Setting of the Test Cycle Parameter

With a higher test cycle value (e.g. 1000ms) the TcDiskTest tool would make fewer disk IOs than a fully utilized TCOSS server, but anyway it may still detect disk bottleneck in the virtual environment if the disk resource is full overloaded.

For example, starting TcDiskTest with the command line

```
TcDiskTest -p1000 -t360000 -dd
```

would produce around 4kByte/s transfer data towards the disk, which is much more less than TCOSS would.

On the other, it could also make sense to simulate the same disk transfer capacity similar with TCOSS in order to see, whether the virtualized environment would provide this capacity also for the longer time.

In this case proceed as follows:

Compute the test cycle based on the disk IOPS value given in the chapter Resource estimation and Key performance Indicators. For example, for the 60-channels TCOSS fax server IOPS=36,

so the test cycle = 1000ms/36 = 27ms

To generate disk load similar to what TCOSS would do for the duration of 100 hours, start the TcDiskTest with the following parameters:

```
TcDiskTest  -p27 –t360000 –dd
```

Setting the test cycle parameter would produce higher disk load, but would better test the suitability of particular ESX environment for the TCOSS operation.

Using TCOSS Internal Performance Counters

Following TCOSS disk Windows performance counters provide a very good means to measure the Key performance Indicators of the TCOSS Server.

(“local disk” counters are always available, “remote disk” counters are only available on the primary master in the tandem operation):

- Avg.Local Disk ms/Write (Average local disk write access latency in ms)
- Peak Local Disk ms/Write (Peak local disk write access latency in ms)
- Avg.Remote Disk ms/Write (Average remote disk write access latency in ms, Tandem Server)
- Peak Remote Disk ms/Write (Peak remote disk write access latency in ms, Tandem Server)
- Avg.remote Disk Network delay ms (Average network latency in ms, Tandem Server)
- Peak. remote Disk Network delay ms (Peak network latency in ms, Tandem Server)

Average counters (“Avg.”) indicate the average of the particular value between two subsequent performance monitor measures.

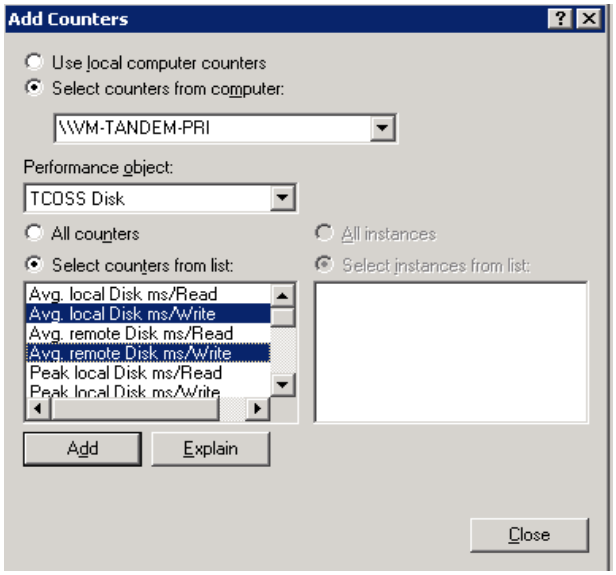
Peak counters (“Peak”) indicate the peak value between two subsequent performance monitor measures

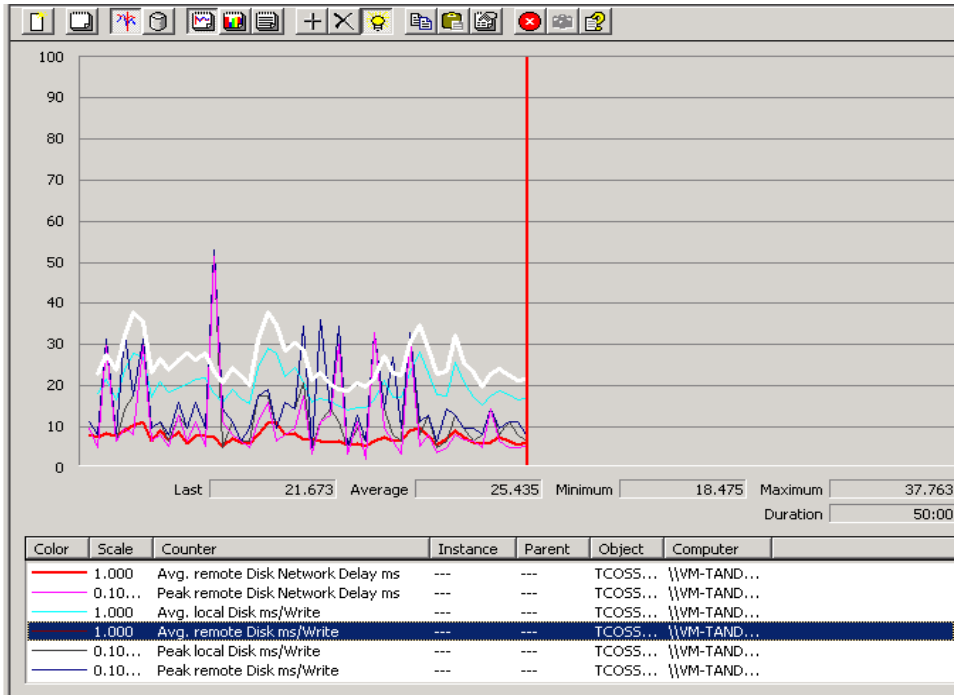
The Avg. and Peak Remote Disk ms/Write counters indicate the whole duration of the remote disk write access (network latency + write disk operation).

The Avg. and Peak remote Disk Network delay ms counters indicate the network portion of the remote disk write operation (network latency).

Further useful counter is the Write Queue Length Peak (also for the TCOSS Disk performance object). Its value should be constantly lower than 16 for a good TCOSS operation, if it often shows 16 it is a good indication that there is a disk access bottleneck in the TCOSS.

Select TCOSS Disk write and remote disk network counters to add them in the Windows performance monitor:





In the screenshot above, the average remote disk network delay is below 10ms (which is sufficient for smaller TCOSS systems with up to 40 lines), and the average remote Disk counter has spikes reaching up 37ms.

So the worst case of the remote disk write access time can be computed like 37ms-10ms= 27ms, which would fulfill the requirements for a small TCOSS system with up to 20 lines.

5.4.3 Checking Network Latency

In order to verify whether there are any network bottlenecks the easiest way is to observe so called round-trip-time (RTT) values between particular nodes communicating through the network (note that the primary-secondary network latency is observed by the dedicated remote disk network delay counter).

The RTT counter is the time that elapses between sending a data request from one node to the other and receiving a data response back in the sending node.

TCOSS provides following Windows performance counters to observe the network communication between:

1. TCOSS and LS1 servers and/or FoIP servers:

   TCOSS Links\Avg. Packet-Ack Time ms

   TCOSS Links\Peak Packet-Ack Time ms

   The counters indicate basically network round-trip-time between the TCOSS and LS1 or FoIP servers. However, the value may include and additional delay of 0 … 300ms that may have occurred during handling of the packet on the responding node.

2. TCOSS storage and media servers:

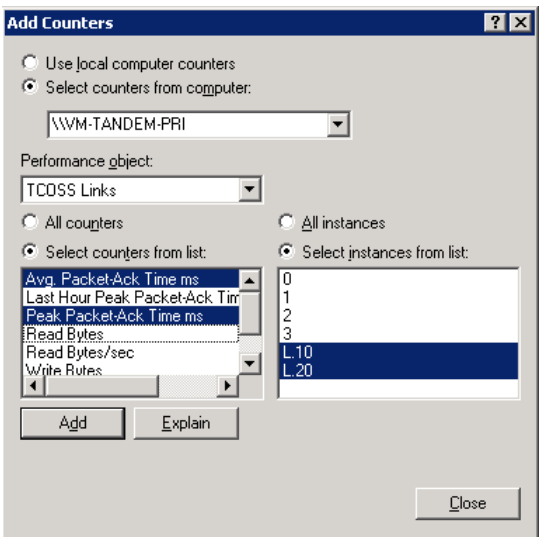
   TCOSS Links\Avg. Round Trip Time ms

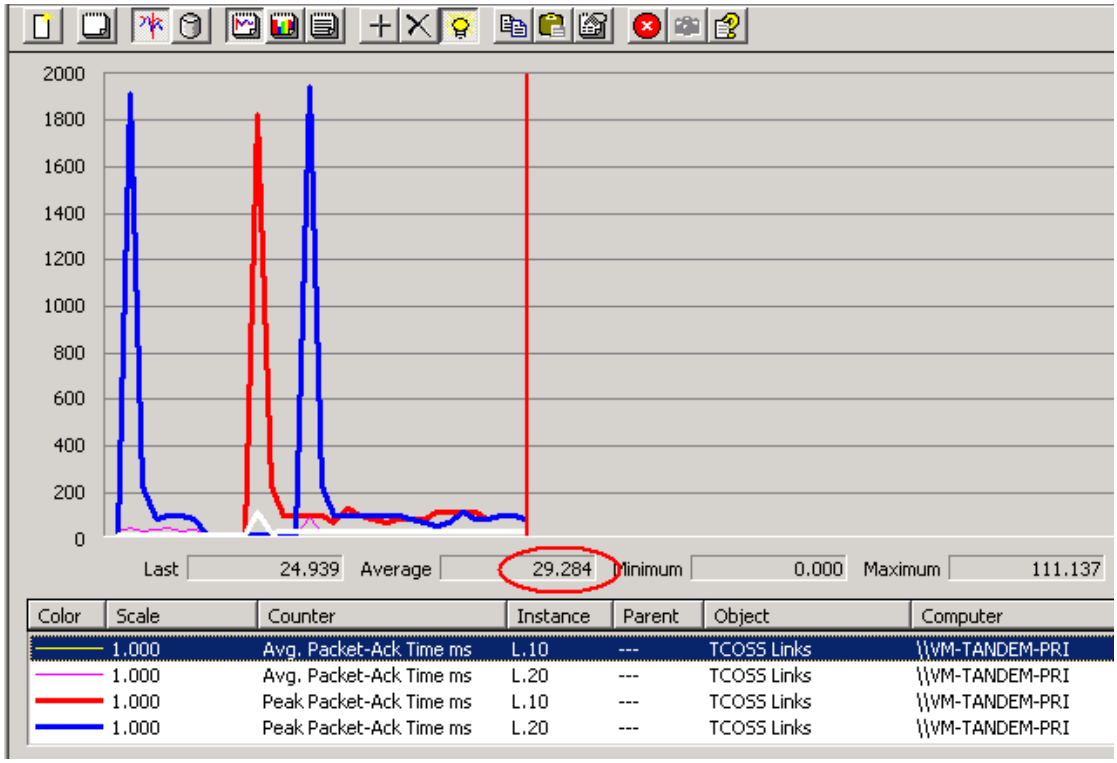
   TCOSS Links\Peak Round Trip Time ms

   The counters indicate the real network round-trip-time between the storage and connected media servers (do not include any delay on the media server)

For the detailed description of these counters, please refer to the TCOSS System Manual.

Select TCOSS Links counters to add them in the Windows performance monitor (in the example below we want to observer 2 LS1 servers connected as nodes L.10 and L.20:





After some time it can be seen that the average Packet-Ack counters are within the limit (<50ms), but there are too high spikes on the peak Packet-Ack counters (reaching up to 2000ms, see blue and red graph above).

This means that the network between the TCOSS and LS1 servers does not fulfill requirements (peaks must be lower than 1000ms). As a consequence, such network spikes may often cause LS1 reboots!

Eventlog Entries on Resource Bottlenecks

During the TCOSS operation, the most crucial Key Performance Indicators ("KPIs") are being observed and checked against configurable threshold limits. If these limits are exceeded, corresponding Windows event log entries are generated.

Two kinds of measures are being computed:

1. Average of the particular value during the last measurement cycle
2. Peak of the particular value that occurred during the last measurement cycle

If any of these values (average or peak) exceeds corresponding threshold, following event log types would be written:

1. If average for the particular counter exceeds its threshold limit, the event log of the type "Warning" would be written (and thus sets the error state of this counter to warning). If the counter being in the Warning state exceeds its threshold limit during any later measurement cycle, the Warning event log would be also written.

2. If the average for the particular counter being in the warning fulfills its threshold limit, the event log of the type "Information" would be written (and thus sets the error state of this counter to Ok).

3. If peak for any counter exceeds its threshold limit, the event log of the type "Information" would be written (but no error state of peak counters is being kept).

The measurement cycle is by default set to 60 seconds, and can be configured in the following registry value

(but it cannot be set lower than to 60 seconds, each value lower than 60 seconds would be set back to 60 seconds !)

```
HKLM\Software\TOPCALL\TCOSS\PerfCounterCheckCycle
```

Following table provides an overview of Key Performance Indicators that are being checked, their default threshold limits and corresponding event log IDs:

KPI thresholds (in ms)			Configuration (HKLM\SW\TOPCALL\TCOSS\...)	EventLogID	
				Warning	Information
KPI(1)	Default thresholds				
Local Disk Write Latency [ms]	Avg.	20	DiskLocalAvgAccessTime	16054	16060
	Peak	2000	DiskLocalPeakAccessTime	-	16055
Remote Disk Write Latency [ms]	Avg.	25	DiskRemoteAvgAccessTime	16056	16061
	Peak	2000	DiskRemotePeakAccessTime	-	16057
$RTT_{prim\text{-}sec}$	Avg.	10	DiskAvgNetworkDelay	16058	16062
	Peak	500	DiskPeakNetworkDelay	-	16059
RTT_{ls1} RTT_{FoIP}	Avg.	300	NodeAvgRoundTripTime	16063	16065
	Peak	1000	NodePeakRoundTripTime	-	16064
$RTT_{storage\text{-}media}$	Avg.	10	MediaServerAvgRoundTripTime	16066	16068
	Peak	500	MediaServerPeakRoundTripTime	-	16067

(1) Please refer to the chapter Resource Estimation and Key Performance Indicators for detailed KPI description

Each event log entry saves following additional information on the counter threshold violation:

1. Counter name and its value that violated its limit (average or peak)
2. In the case of average counter violation, the corresponding peak value of the same counter (and vice versa)
3. Information in percent how many values exceeded the average and peak limits
4. Information on the limit values for both average and peak thresholds
5. The duration of the measurement cycle (default 60 seconds)

Note that it can happen during an idle period of TCOSS (e.g. no faxes being currently active) that the measurement cycle indicated would be much longer that the configured value (e.g. 7000 seconds). This is cause by the fact that counter verification is done only during regular TCOSS (disk) activity.

Example of the Warning event log written in the case of average counter threshold violation:

```
Avg.local disk write time 30 ms exceeded avg.limit, peak was 360 ms, 0 perc. values
exceeded peak limit (1000 ms), 53 perc. values exceeded avg.limit (25 ms) during
last 60 sec
```

Example of the Information event log written in the case above average counter does not exceed its limit anymore:

```
Avg.local disk write time 19 ms is within avg.limit again, peak was 360 ms, 0 perc.
values exceeded peak limit (1000 ms), 53 perc. values exceeded avg.limit (25 ms)
during last 60 sec
```

5.5 KCS Components Supported on Virtual Environment

This chapter lists KCS components supported on virtual environment.

5.5.1 Supported Client Applications

TCfW Communication Server Client

5.5.2 Supported KCS Server Components

1. Administrative Tools (Group)
    I. KCS Monitor
    II. KCS License Tool – TC/LT
    III. TC15 Tool
    IV. TCPMeter
    V. KCS Monitoring
    VI. KCSBackup
    VII. TC/PerfLog
2. MAKETCOSS
3. TCOSS (Group)
    I. TCOSS
    II. TCOSS 01 for ASP … TCOSS 10 for ASP
4. Status Agent (Group)
    I. Status Agent
    II. Status Agent 01 for ASP … Status Agent 10 for ASP
5. TC/Archive (Group)
    I. TC/ARCHIVE
    II. TC/Archive 01 for ASP … TC/Archive 10 for ASP
6. Fax over IP (all components) (see *KCS Fax over IP* for details)
7. TCDC (Group)
    I. TCDCSIGN
8. IP Printer (Group)
    I. IpPrinter
    II. IpPrinter 01 … IpPrinter 10
9. TC/Message Release Manager

10. SNMP Support (Group)
    I. SNMP Sample Scripts (Group)
    i. Tivoli NetView Sample Scripts
    ii. HP OpenView Sample Scripts
    II. SNMP Support Tools (Group)
    i. MIBMAKER
    ii. SNMP_CONFIG
    iii. MIB Files
    III. TCSNMP
11. TC/Probe Agent
12. TC/Report (Group)(*)
    I. TC/Report Report
    II. TC/Report Fetch
    III. TC/Report Request Client
13. TC/Web(*)
14. Application Interfaces and Services (Group)
    I. TFC
    II. TCSRV
    III. TWS
    IV. DocConv
    V. KCS – Capture Connector

(*) Refer to the chapter *Restrictions*

KCS Fax over IP, T.38 mode

KCS Fax over IP has been certified with up to 120 IP fax channels on one virtual machine.

Tested ESXi hardware:

- HP ProLiant DL380 G7, 12 CPUs x 2,665 GHz (X5650), 24 GB Memory, HP Smart Array P410i/1GB
  Raid 1 (2 x 300GB SAS 15k) for VMware Server
  Raid 5 (5 x 300GB SAS 15k) for Storage

Tested software:

- VMware vSphere 5 Hypervisor – licensed for 2 physical CPUs
  ESXi, 5.1.0, Build 799733
- Guest operating system: Windows Server 2008 R2 SP1 English

Recommendations:

- Reserve at least 1 core (2665MHz) for FoIP with 30 channels
- Reserve at least 2 cores (5330MHz) for FoIP with 60 channels
- Reserve at least 3 cores (7995MHz) for FoIP with 90 channels
- Reserve at least 4 cores (10660MHz) for FoIP with 120 channels
- Assign at least 4 GB RAM
- See chapter Prerequisites in Fax over IP Technical Manual for more details.

KCS Fax over IP, pass-through mode

Tested hardware:

- HP ProLiant DL380 G7, 12 CPUs x 2,665 GHz (X5650), 24 GB Memory, HP Smart Array P410i/1GB

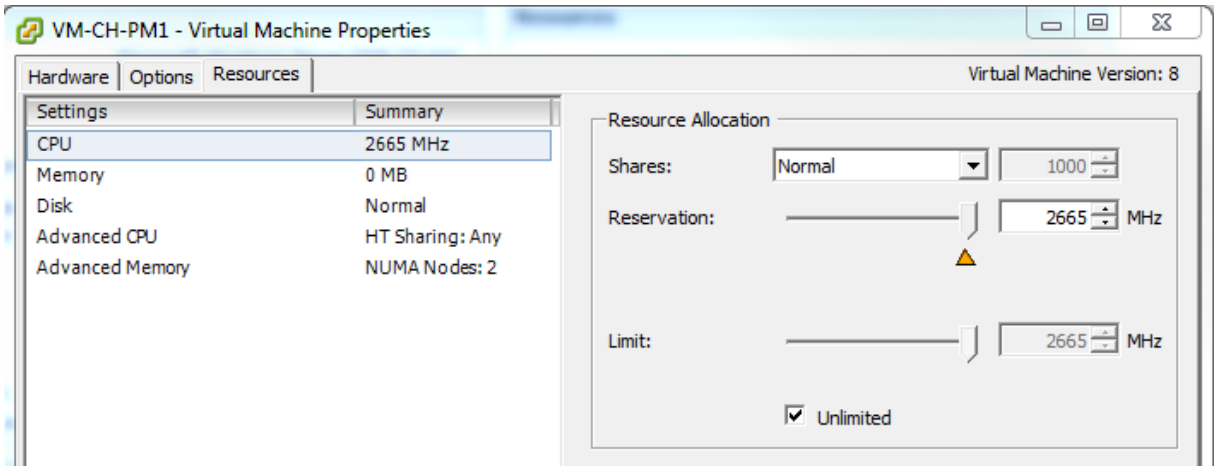
Tested software:

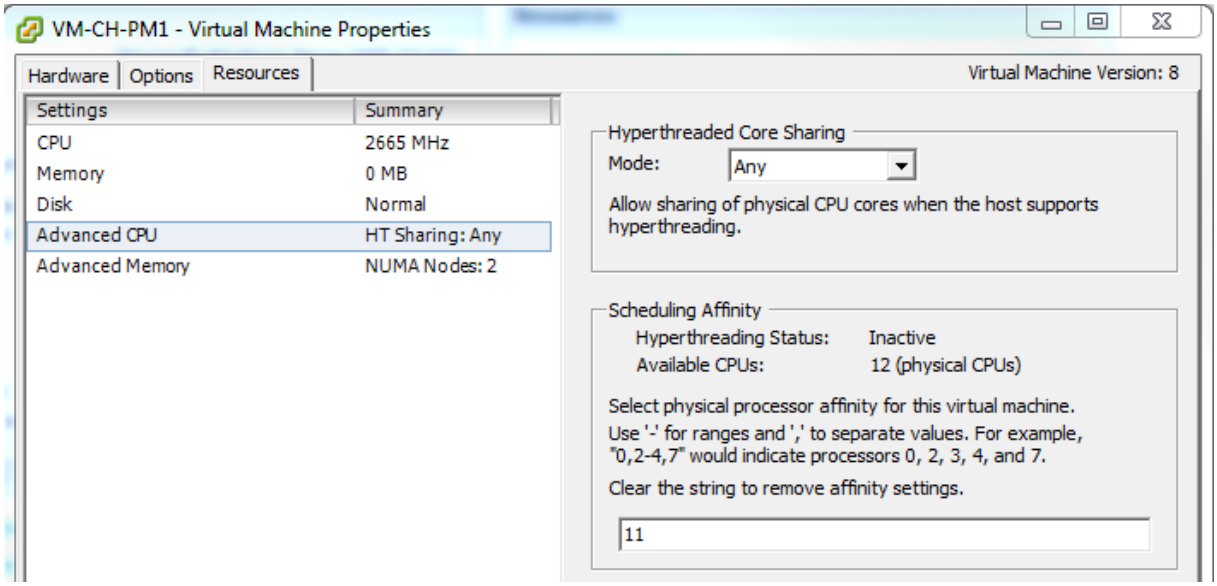
- VMware ESXi, 5.5.0, Build 1331820
- Windows 2012 R2 Host with Hyper-V-Role
- Guest operating systems:
  Windows Server 2008 SP2 Standard 32-bit
  Windows Server 2008R2 Enterprise SP1 64-bit
  Windows Server 2012 64-bit

Recommendations:

- Deactivate Hyperthreading

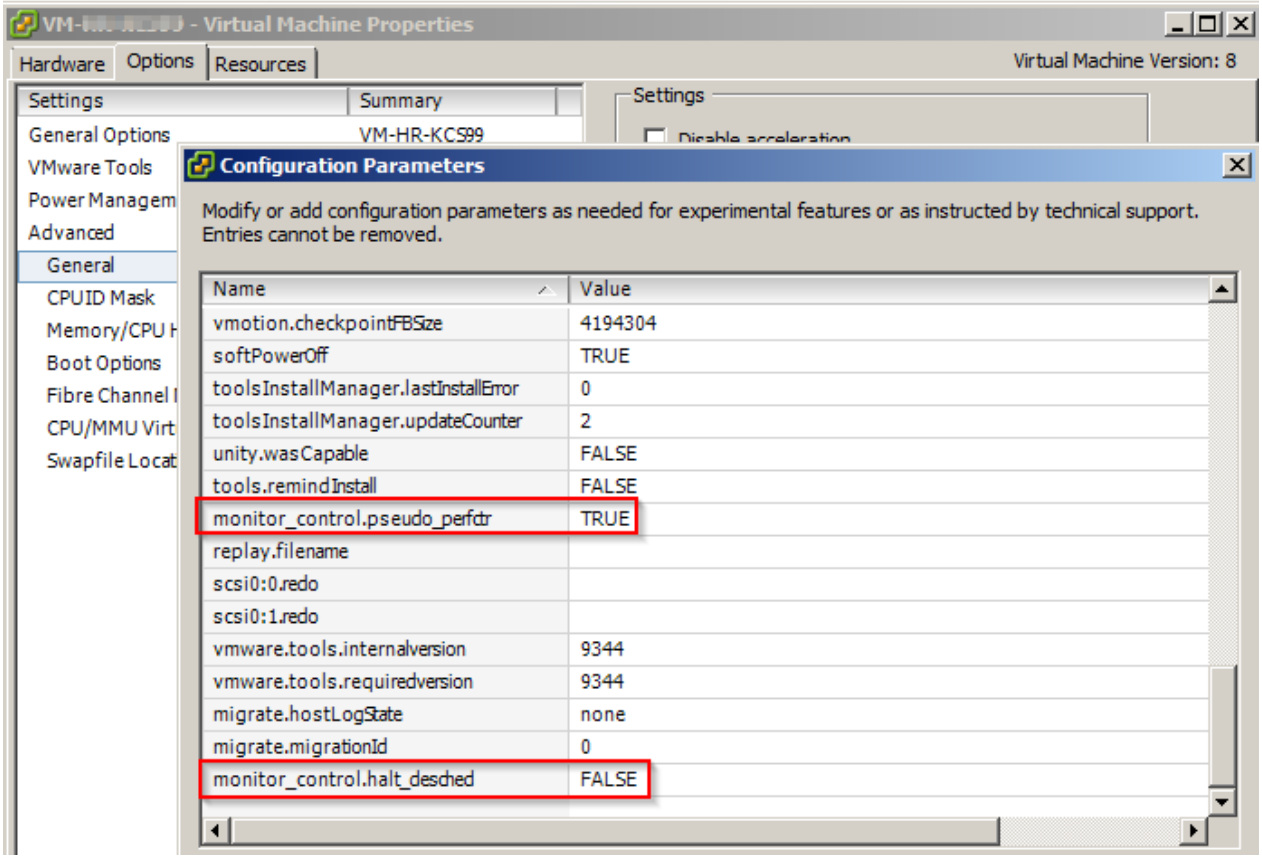
- Under VMware assign or more unlimited CPUs and use processor affinity to assign physical CPU(s):



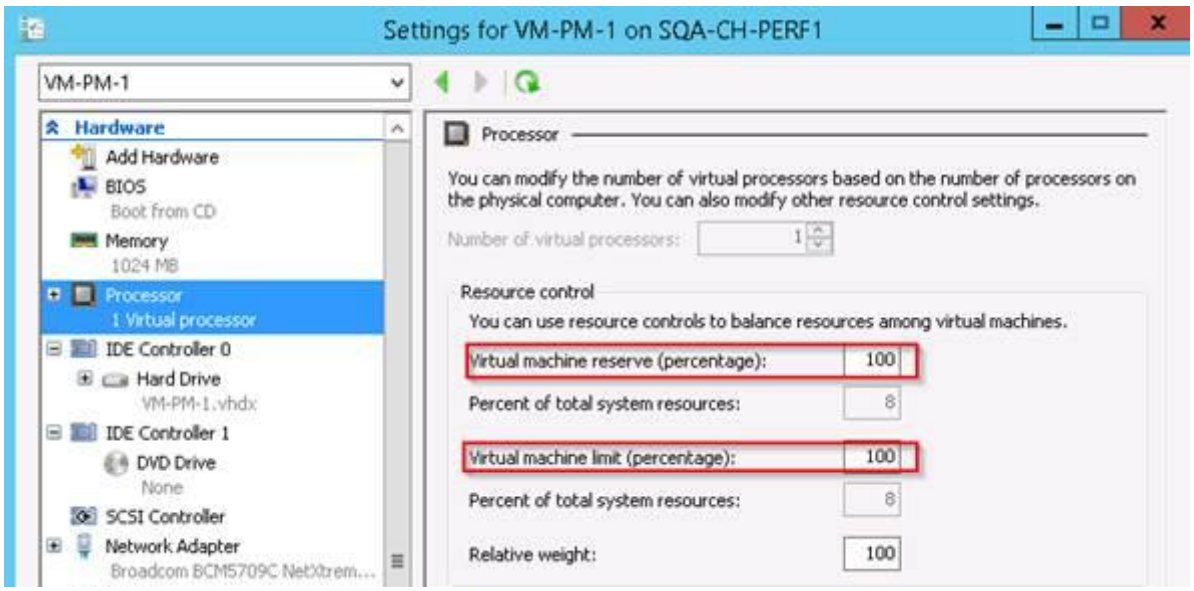


Note: The affinity must be set on all virtual machines and all other machines must NOT use the processes assigned to the KCS FoIP VM in there affinity mask. E.g. use affinity mask 0-10 for all aother VM's in the example above so that CPU 11 is reserved for the KCS FoIP VM!

- Under VMware set the following advanced configuration parameters in "Virtual Machine Properties" – "Options" – "Advanced" - "General" – "Configuration Parameters":
    - Set "**monitor_control.pseudo_perfctr**" with a value of "**TRUE**" do activate pseude performance counters. They are optimally used by FoIP passthrough mode to improve detection of performance related problem.
    - Set "**monitor_control.halt_desched**" with value of "**FALSE**" do keep the FoIP passthrough mode jitter low, if the CPU usage is low.



- Under Hyper-V assign unlimited and 100% reserved CPU(s):



The maximum number of channels depends on the number of assigned CPU cores as shown in the table below:

Number of Cores	Max. number of channels
1	10
2	20
4	40
8	80
12	120

Notes:

- At least 2 cores should be reserved for optimum quality
- The values are valid for a hardware that is similar or better than the following reference system: HP Proliant DL380G8 (CPU Xeon E5-2640, dual 6-core, 2500MHz)
- The total CPU usage caused by other high priority processes/threads inside the VM that is used for KCS FoIP must be less than 20% from total available CPU usage.

5.5.3 Supported Link Components

The support of link components in virtual environment is limited to all KCS modules. Modules of third-party vendors may work as well, but Kofax does not guarantee their functioning.

The major performance indication of a link server is the message throughput including document conversion.

Therefore, tests were performed that focused on throughput to show the dependencies based on various environment scenarios (physical machine Mod. 300, VMware ESX server, …).

Common parameters for performance measurements of TC/LINK-FI document conversion

1) Used operating system of link server(s) was Windows 2003 SP1 + all patches (available by March 2007) installed
2) Office 2003 Professional SP2 all patches (available by March 2007) installed
3) Used link package TC/LP 2.20.00., newer version of TCDCKey.DLL (2.09.01)
4) All trace levels (general, TCDC, …) have been set to 0
5) TraceLevel on TCOSS server set to 0x1083, TraceFlags set to 0x40
6) Minimum duration of all TCDC conversion throughput measurements was 1 hour
7) Minimum duration of all Lincoln, TCIMG32 and Datalogic Library conversion measurements was 20 minutes
8) PDF conversion done with Acrobat Standard 7.0.8 (using script)
9) Alternatively PDF conversion done with Acrobat Reader 7.0.7 (no script)

Used servers

1. Physical machine Mod. 300
   KCS Mod. 300 – TA11 main board, 512 MB RAM, 1 x 2,8 GHz Xeon processor, SCA hard disk
2. VMware session under ESX server - version 3.0.1 – Build 32039
   VMware session 512 MB RAM, 1 x 2,8 GHz Xeon processor
3. VMware session under (GSX) server - version 1.0.2 39867
   Single VM instance, installed on Win 2003 server with 3 GB physical RAM,
   512 MB used for the VMware session
4. VMware session under VMware Workstation 5.5
   Single VM instance, installed on Win XP with 2 GB physical RAM, SCA hard disk
   512 MB used for the VMware session

Tested functions

Document conversion was tested with a single instance TC/LINK-FI polling a local API directory (to avoid side effects), connected to a single TCOSS server via 100 MBit public LAN. The single TCOSS server is a Mod. 301 with a 28 lines PRI (permanently sending / receiving via all channels). The PRI LS1 is connected via a crossover network cable to the TCOSS server.

Used documents

PDF conversion done with Acrobat Standard 7.0 with TCDC SCRIPT:

Small PDF	4 pages	1,9 MB
Large PDF	570 pages	25,5 MB

DOC, XLS and PPT conversion done with Office 2003 SP2 using TCDC SCRIPT:

Small DOC	2 pages	0,2 MB
Large DOC	372 pages	6,8 MB
XLS	5 pages	0,32 MB
PPT	3 pages	0.16 MB

PS and PCL5 conversion done via LINCOLN converter:

PS	4 pages	3,5 MB
PCL	4 pages	1,4 MB

TIF conversion done via TCIMG32:

TIF	4 pages	0,3 MB

PDF conversion done with Acrobat Reader 7.0 without TCDC SCRIPT:

Small PDF	4 pages	1,9 MB

Test results

Pages/ hour - application not started by TCDCLink

	Acrobat Standard 7.x script				Acrobat Reader 7.x no script		Office 2003 script							
	PDF 570 pages	%	PDF 4 pages	%	PDF 4 pages	%	Doc 372 pages	%	Doc 2 pages	%	XLS 5 pages	%	PPT 3 pages	%
VM WS	19437	73	2045	82	2450	77	21788	70	2106	64	6902	74	4178	58
VM GSX	19704	74	2072	83	2494	78	22388	72	2232	68	4801	52	5170	72
VM ESX	21399	81	2356	95	2556	80	23873	76	2611	79	3464	37	5510	77
Mod. 300	26513	100	2487	100	3196	100	31307	100	3292	100	9300	100	7170	100

Pages/ hour

	Lincoln -2)				TCIMG32 -2)	
	PS 4 pages	%	PCL 4 pages	%	TIF 4 pages	%
VM WS	7692	72	9303	79	26877	82
VM GSX	7543	71	9490	81	25723	79
VM ESX	7446	70	10019	85	27027	83
Mod. 300	10634	100	11742	100	32673	100

Pages/ hour - application started by TCDCLink

	Acrobat Standard 7.x script		Office 2003 script	
	PDF 4 pages	%	Doc 2 pages	%
VM WS	2884	84	2419	42
VM GSX	2915	85	2382	41
VM ESX	3346	97	2829	49
Mod. 300	3434	100	5821	100

Throughput increase application expressed as a percentage - application started/not started

	Acrobat Stand. 7.x script		Office 2003 script	
	PDF 4 pages	%	Doc 2 pages	%
VM WS	141	102	115	65
VM GSX	141	102	107	60
VM ESX	142	103	108	61
Mod. 300	138	100	177	100

Note: Currently, only Virtual Infrastructure 3.x and later (formally known as ESX Server) are supported.

5.6 Hyper-V Support

Kofax Communication Server supports Microsoft's hardware virtualization mode Hyper-V.

The supported host operating system is Windows Server 2008 R2 or later. It is recommended to use Microsoft Hyper-V Server 2008 R2 (http://www.microsoft.com/hyper-v-server/en/us/default.aspx) instead of a normal Windows Server with the server role Hyper-V.

The supported guest operating systems are Windows Server 2008 and later.

Required Resources

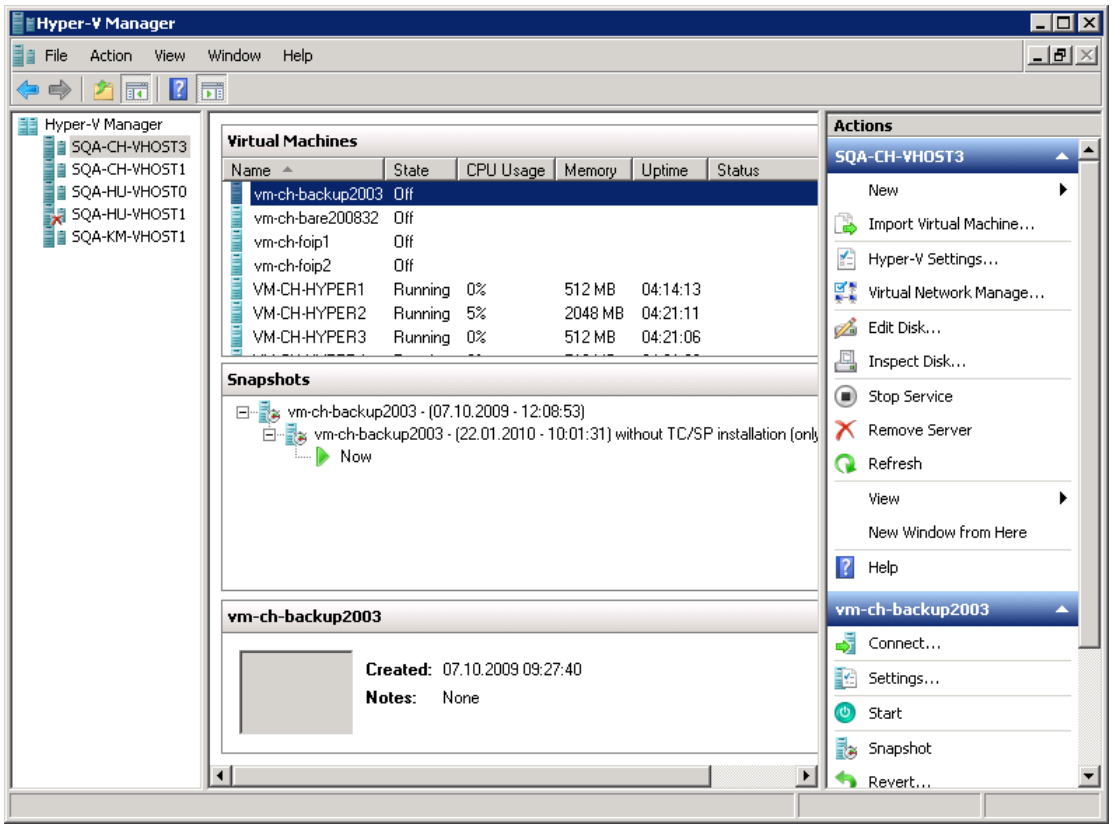
To estimate the required resources required by the virtual machines, measuring the performance data of a real system can prove valuable. Please refer to the following chapters

- *Resources Estimation for Existing Customers*
- *Resources Estimation for New Customers*

The TCDiskTest tool can be used to test access to the hard disk. For more information, refer to chapter *Using TcDiskTest Tool*.

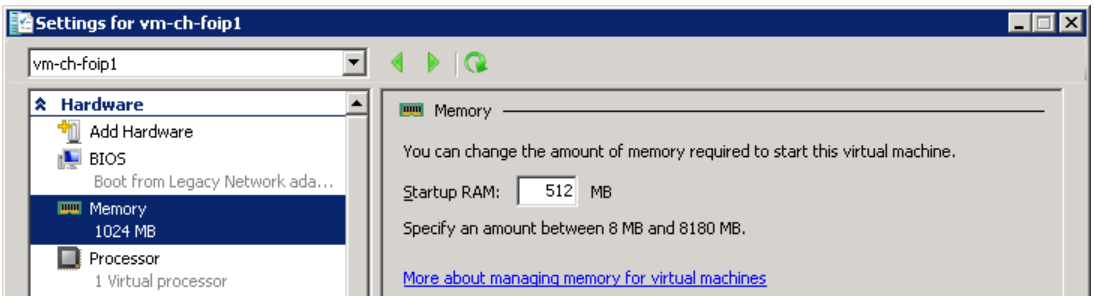
Managing Hyper-V

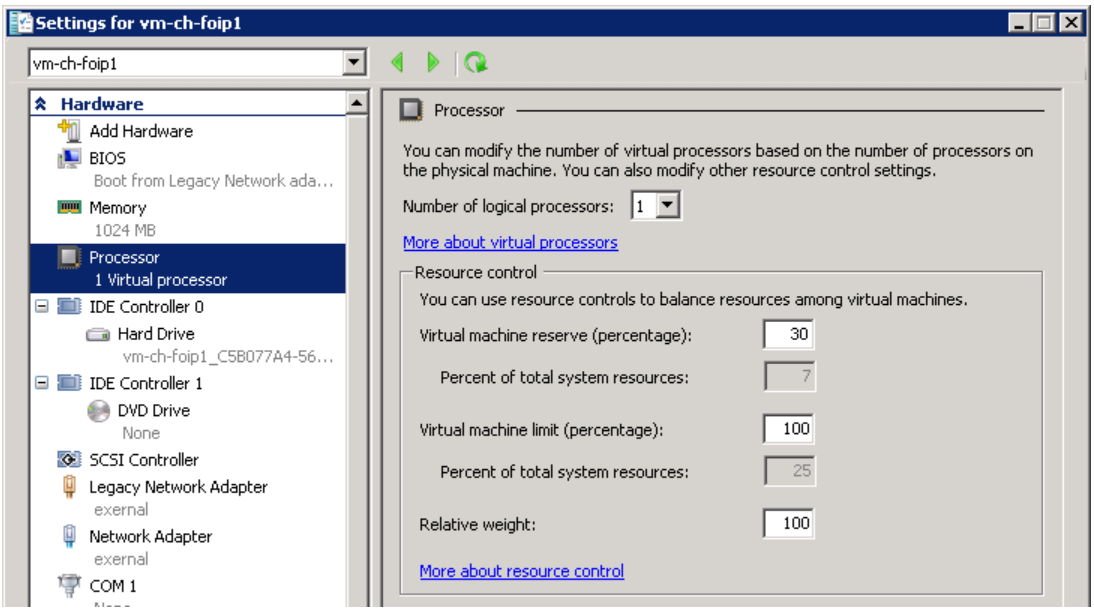
Hyper-V can be configured via the Hyper-V Manager (a Microsoft management console snap-in, part of administrative tools).



For virtualization of KCS, the most important settings are in the sections Memory and Processor. Select a virtual machine and click Settings.

Note: The values in the screen shots below are just an example.





In the example above, one logical processor (2 GHz) is assigned to the virtual machine. The “Virtual machine reserve (percentage):” is set to 30 percent. Effectively, this machine has one processor (2 GHz) and 615 MHz are reserved for this virtual machine. The virtual machine was assigned 512 MB RAM.

Supported KCS Components

All KCS components supported on VMware are also supported on Hyper-V. For more information, see *KCS Components Supported on Virtual Environment*.

Similar restrictions and hints like for VMware apply also for Hyper-V. See chapters *Restrictions* and *Hints*.

The KCS core, i.e. TCOSS, must be installed on a dedicated virtual machine.

All other KCS applications connecting to the TCOSS must run on other virtual machines than TCOSS. It is recommended to connect their VNICs (virtual network adapters) to the same network adapter as the VM of TCOSS.

Tests and Performance Observations

Hyper-V was tested on an Intel XEON E5405@2GHz (Quad Core) computer with 7 GB memory.

The virtual machine was assigned one logical processor (2 GHz). The virtual machine reserve was not configured; however, not much else was happening on the host computer. The virtual machine was assigned 2048 MB memory. The host operating system was Windows Server 2008 R2; the guest operating system was Windows Server 2008 R2 as well.

Several KCS server package 7.86.00 components were installed on the host, most prominently TCOSS with 60 fax channels, connected with two LS1V2, each with 30 fax channels.

In such a configuration with 60 fax channels running in parallel, test ran successfully with an average CPU usage of the virtual machine at around 13 percent.

Similar configuration with 30 FoIP channels was tested successfully as well.

During tests it was observed that extensive disk operations on the host (e.g., copying large volume of data) may result in a dramatic performance decrease on the guest.

5.7 Restrictions

- From VMware only ESX Server is supported. VMware Workstation, VMware Player, and VMware Server (formerly called VMware GSX Server) are NOT supported.
- Hyper-V is only supported with Windows Server 2008 R2 or later as host operating system.
- A Tandem system can only be supported if the primary server is on another physical host than the secondary server.
- With TC/Archive, TC/Juke or a DVD/CD writer are not supported. Only network storage is supported.
- If there are timeouts or low throughputs, increase the allocated resources on the virtual machine or use dedicated hardware!
- Maximum of 150 LS1(V2) of FoIP Fax channels are supported per TCOSS (single or tandem) server. See *Test: 150 Fax Channels* and see *KCS Fax over IP* for details
- Not more than 10 instances of IPPrinter are supported, although more instances can be installed.
- LSD cannot be supported, as no serial interface is available on virtual machines.
- TCOSS must run on a single virtual machine (max. 10 instances)
- TC/Report is only supported if the SQL Server is not running on the same machine. Running TC/Report on MSDE or SQL Express is not supported.
- TC/Web installations on virtual machines are supported from KCS 10.0.x.
- Voice applications are not supported on virtual machines.
- TC/MA is not supported.

5.8 Hints

5.8.1 MAC Address Locking

If you want to run the KCS systems on VMware clusters, you have to lock the MAC address on the TCOSS server.

If this is not done, there will be licensing problems when TCOSS boots up on another cluster server.

For more details on MAC address locking see:

http://kb.vmware.com/vmtnkb/search.do?cmd=displayKC&docType=kc&externalId=507&sliceId=SAL_Public

5.8.2 Resource Bottlenecks Caused by Virus Scanners

If there are several VMs running on a particular ESX server and there are any virus scanners installed on these VMs, these virus scanners should be set up so that they wouldn't start their virus check cycle at the same time. If so, they may cause substantial bottleneck on system resources, especially CPU and disk bandwidth, and as a consequence, fax transmission error rate may increase dramatically during such a period of time.

5.9 Test: 150 Fax Channels

KCS was successfully tested with 150 fax channels on virtual computers in a tandem configuration.

Hardware:

- Host system 1 (primary master and status agent): HP Proliant DL380 G7, CPU Intel Xeon E5645 2.4 GHz, 2 processor sockets with 6 cores each, 12 GB RAM, HP Smart Array P410i Controller, Raid 1+0
- Host system 2 (secondary master): HP Proliant DL380 G7, CPU Intel Xeon X5650 2.665 GHz, 2 processor sockets with 6 cores each, 24 GB RAM, HP Smart Array P410i Controller, Raid 1+0

Virtualization settings:

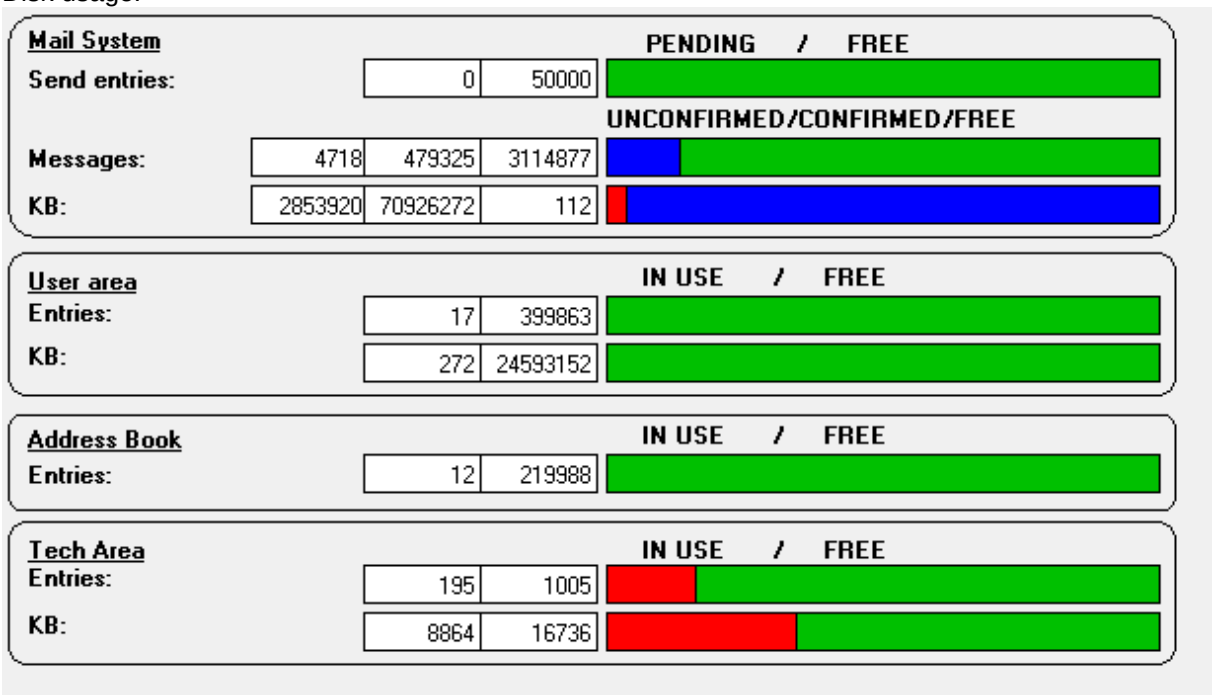
- Host software: ESXI 5.5.0, free license
- Primary master virtual machine: using 4 processor cores, speed not limited
- Secondary master virtual machine: using 4 processor cores, speed limited to 2,4 GHz
- Windows Server 2008 R2 Enterprise x64

Test work flow:

- Test messages consisting of an XML body in TC/XML format with linked PDF attachments are automatically created by a test script and put into the network share polled by the TC/LINK-XML instances.
- TC/LINK-XML takes the messages from the network share, adds a TCI alternative for the PDF attachments and puts them into TCOSS, to be sent out as faxes.
- TCOSS sends the messages on the 75 outbound fax lines, which are connected to the 75 inbound fax lines, creating back-reception documents and notifications.
- The notifications are processed by TC/LINK-XML and put into a "NOTIF" directory on the network share (to be deleted by a script)
- The received faxes are routed to a queue polled by the KCS Capture Connector via TWS, transferred to Kofax Capture and marked completed in TCOSS.

The TCOSS file structure size is 100 GB, with 4 million file entries. There are 50,000 mail entries and 220,000 address book entries.

Disk usage:



5.9.1 Test Results: Three-Page Messages

The TCOSS cache was set to the defaults:

Registry key	Value
TCOSS/Drive0/DirCacheSize	2048
TCOSS/Drive0/DocCacheSize	40960
TCOSS/Drive0/DataBaseCacheSize	5120

This test run was done with messages of 3 pages, one short text page and 2 rather large image pages consisting of the CCITT fax test image. The outbound messages were put into TCOSS by two TC/LINK-XML instances, 1 on the primary and 1 on the secondary master. Outbound message size in TCOSS was about 440,000 bytes (PDF attachments plus TCI alternative). The size of the received messages was about 325,000 bytes.

The message throughput was 60 messages per minute, 30 outbound and 30 inbound (received fax) messages. This gives a fax line usage of 150 seconds per message, including the idle time between message transmissions.

Entering these values into the HW-Requirements Calculator gives:

KOFAX Communication Server HW-Requirement Calculator

	inbound		outbound		total
	fax	link	link	fax	
number of fax lines	75			75	150
keep log file (0/1)	1			1	
route via in-action (0,1,2,..)	1				
sending with back-reception (0/1)				1	
sending with delivery notification (0/1)				1	
average message size in bytes	325000		440000	440000	
fax line usage per message in seconds	150			150	
average number of pages	3		3	3	
average page size in bytes	108333,3333			146666,6667	
peak message throughput per hour	1800	1800	1800	1800	
peak message throughput per second	0,5	0,5	0,5	0,5	
database writes per message	4	4	1	9	
directory writes per message	7	1	2	6	
document writes per message	29	2	32	35	
disk writes per message	40	7	35	50	
database writes per second	2	2	1	5	9
directory writes per second	4	1	1	3	8
document writes per second	15	1	16	18	49
disk writes per second	20	4	18	25	66
average disk access time in ms					15,2

The following values were measured with the Performance Monitor (on the primary system):

Object	Instance	Counter	Value
Physical Disk	D: (TCOSS)	Disk Writes/sec	61
		Disk Write Bytes/sec	590,000
		Disk Reads/sec	43
		Disk Read Bytes/sec	670,000
		%Disk Write Time	35
		%Disk Read Time	4.5
TCOSS Cache	Database	Cache Misses/sec	0
	Directory	Cache Misses/sec	0,5
	Document	Cache Misses/sec	43
Processor	_Total	% Processor Time (0 ..100)	17
Process	TCOSS	% Processor Time (0 ..400)	24
	TCLINK	% Processor Time (0 ..400)	23
	TWS processes	% Processor Time (0 ..400)	9
	TCOSS	Private Bytes	412,000,000
		Virtual Bytes	923,000,000

5.9.2 Test Results: Two-Page Messages

The TCOSS cache was set like this:

Registry key	Value
TCOSS/Drive0/DirCacheSize	10240
TCOSS/Drive0/DocCacheSize	409600

TCOSS/Drive0/DataBaseCacheSize	51200

The test run was done with messages of 2 pages, both average image pages resulting from the input PDF attachment. The outbound messages were put into TCOSS by four TC/LINK-XML instances, 2 on the primary and 2 on the secondary master. Outbound message size in TCOSS was about 150,000 bytes (PDF attachments plus TCI alternative). The size of the received messages was about 135,000 bytes.

The message throughput was 150 messages per minute: 75 outbound and 75 inbound (received fax) messages. This gives a fax line usage of 60 seconds per message, including the idle time between message transmissions. The duration of the transmission, as seen in the outbox, was 46 ..47 seconds.

The number of messages put into TCOSS by the links was a bit larger than the number processed by the fax lines, so outbound message were queuing up in TCOSS at a rate of about 700 per hour.

The TCOSS cache worked very well up to about 700 queued outbound messages, and was less efficient with more queued outbound messages. The performance counter values below are taken from the phase with more queued messages because this situation persisted during most of the test run.

The following values were measured with the Performance Monitor (on the primary system):

Object	Instance	Counter	Value
Physical Disk	D: (TCOSS)	Disk Writes/sec	100
		Disk Write Bytes/sec	640.000
		Disk Reads/sec	16
		Disk Read Bytes/sec	204.000
		%Disk Write Time	62
		%Disk Read Time	3
TCOSS Cache	Database	Cache Misses/sec	1,7
	Directory	Cache Misses/sec	1
	Document	Cache Misses/sec	12,5
Processor	_Total	% Processor Time (0 ..100)	34
Process	TCOSS	% Processor Time (0 ..400)	31
	TCLINK	% Processor Time (0 ..400)	26
	TCLINK#1	% Processor Time (0 ..400)	26
	TWS processes	% Processor Time (0 ..400)	14
	TCOSS	Private Bytes	848.000.000
		Virtual Bytes	1.364.000.000

Entering the above throughput values into the HW-Requirements Calculator gives:

KOFAX Communication Server HW-Requirement Calculator

	inbound		outbound		total
	fax	link	link	fax	
number of fax lines	75			75	150
keep log file (0/1)	1			1	
route via in-action (0,1,2,..)	1				
sending with back-reception (0/1)				1	
sending with delivery notification (0/1)				1	
average message size in bytes	135000		150000	135000	
fax line usage per message in seconds	60			60	
average number of pages	2		2	2	
average page size in bytes	67500			67500	
peak message throughput per hour	4500	4500	5200	4500	
peak message throughput per second	1,3	1,3	1,4	1,3	
database writes per message	4	4	1	8	
directory writes per message	6	1	2	6	
document writes per message	16	2	14	16	
disk writes per message	26	7	17	30	
database writes per second	5	5	1	10	21
directory writes per second	8	1	3	8	19
document writes per second	20	3	20	20	63
disk writes per second	33	9	25	38	**103**
average disk access time in ms					**9,7**

5.9.3 Test Results: Secondary Master Failure

The error scenario of a secondary master failure was simulated by stopping the TCSRV service on the secondary master. The status agent was running during the tests.

The secondary master was stopped for 10 minutes, the test loop continued running. There was no noticeable change in the performance of the primary master while it was running stand-alone, which means that the tandem operation did not slow down the test workload.

After the secondary master was restarted it took about 45 minutes to update the primary master and come back to the fault-tolerant mode.

The following performance values were measured on the primary master during the re-synchronization phase. In the first test run the queue length of outbound faxes was below 700 and the TCOSS cache worked well reducing disk reads to about 3 per second:

Object	Instance	Counter	Value
Physical Disk	D: (TCOSS)	Disk Writes/sec	99
		Disk Write Bytes/sec	622,000
		Disk Reads/sec	56
		Disk Read Bytes/sec	883,000
		%Disk Write Time	61
		%Disk Read Time	2.3
TCOSS Disk		Read kB/sec	14
		Reads/sec	3.4

		Update kB/sec	848
		Update Write kB/sec	216
TCOSS Cache	Database	Cache Misses/sec	1
	Directory	Cache Misses/sec	1
	Document	Cache Misses/sec	1.4
Processor	_Total	% Processor Time (0 ..100)	33
Process	TCOSS	% Processor Time (0 ..400)	32

The TCOSS performance counter “Update kB/sec” shows the amount of data read from the primary master, the performance counter “Update Write kB/sec” gives the amount written to the secondary master. The difference between the two is the data which turned out to be equal on the secondary master’s disk so it was not written.

The additional disk reads (848 kB/sec, 53 Reads/sec) resulting from the update of the secondary master cause no problem for the physical disk, the disk read time does not go up, probably because these disk reads are in sequential order, not random like the other TCOSS disk reads.

In the second run of this test case the queue length of outbound faxes was above 700 and the TCOSS cache worked less efficiently. The update was running a bit slower in this case (698 kB/sec):

Object	Instance	Counter	Value
Physical Disk	D: (TCOSS)	Disk Writes/sec	99.5
		Disk Write Bytes/sec	628,000
		Disk Reads/sec	59
		Disk Read Bytes/sec	909,000
		%Disk Write Time	62
		%Disk Read Time	6.5
TCOSS Disk		Read kB/sec	189
		Reads/sec	15
		Update kB/sec	698
		Update Write kB/sec	181
TCOSS Cache	Database	Cache Misses/sec	1
	Directory	Cache Misses/sec	1
	Document	Cache Misses/sec	13
Processor	_Total	% Processor Time (0 ..100)	33
Process	TCOSS	% Processor Time (0 ..400)	32

The about 12 additional, random TCOSS disk reads cause the disk read time to go up a bit.

5.9.4 Test Results: Primary Mastery Failure

To test this situation the TCSRV service was stopped on the primary master while the tandem system was in a healthy, fault-tolerant state. The secondary master started stand-alone, it took 21 minutes to boot all 38 line servers. After about 15 minutes the primary master was restarted, it took the primary about 20 minutes to boot all line servers. About an hour later the update of the primary master from the secondary was completed.

The following performance values were measured on the primary master during the re-synchronization phase:

Object	Instance	Counter	Value
Physical Disk	D: (TCOSS)	Disk Writes/sec	118
		Disk Write Bytes/sec	952,000
		Disk Reads/sec	8.7
		Disk Read Bytes/sec	143,000
		%Disk Write Time	71

		%Disk Read Time	0.8
TCOSS Disk		Read kB/sec	199
		Reads/sec	16
		Write kB/sec	595
		Writes/sec	97
		Update kB/sec	454
		Update Write kB/sec	335
TCOSS Cache	Database	Cache Misses/sec	1.7
	Directory	Cache Misses/sec	1.4
	Document	Cache Misses/sec	13
Processor	_Total	% Processor Time (0 ..100)	31
Process	TCOSS	% Processor Time (0 ..400)	29

The additional disk writes caused by the update from the secondary master are seen in the TCOSS Disk performance counter “Update Write kB/sec”. The 335 kB are written in 16 kB blocks and cause about 21 additional disk writes per second. Together with the 97 Writes/sec from regular TCOSS activity they sum up to the 118 Disk Writes/sec observed on the physical disk.

The low value of 8.7 in the “Disk Reads/sec” performance counter of the physical disk is probably caused by the OS disk cache. According to the TCOSS Disk performance counter “Reads/sec” there are 16 reads from regular TCOSS activity, plus some from the tandem update.

During the tandem update phase the outbound fax queue length was stable at around 5600. The performance numbers of the case without tandem update were done with an increasing queue length (at a rate of about 700 per hour). This would explain the lower number of Writes/sec from regular TCOSS activity (97 vs. 100). The tandem update did not slow down the test message work flow.

5.9.5 Test Results: Two-Page Messages and Increased TCOSS Cache

This test was done with the same workload as in the two-page messages test above, only the TCOSS cache size was increased:

Registry key	Value
TCOSS/Drive0/DirCacheSize	20480
TCOSS/Drive0/DocCacheSize	1024000
TCOSS/Drive0/DataBaseCacheSize	102400

The TCOSS document cache started to fail after about 1700 outbound messages had been queued up. The other queues, inbound messages and notifications, were stable throughout the test and both below 100.

These values were measured on the primary system with less than 1700 message queued:

Object	Instance	Counter	Value
Physical Disk	D: (TCOSS)	Disk Writes/sec	103
		Disk Write Bytes/sec	635,000
		Disk Reads/sec	2.7
		Disk Read Bytes/sec	5,700
		%Disk Write Time	66
		%Disk Read Time	1.3
TCOSS Cache	Database	Cache Misses/sec	0.6
	Directory	Cache Misses/sec	1.3
	Document	Cache Misses/sec	0.8
Processor	_Total	% Processor Time (0 ..100)	33
Process	TCOSS	% Processor Time (0 ..400)	30
	TCOSS	Private Bytes	1,554,000,000
		Virtual Bytes	2,069,000,000

With more than 1800 messages in the outbound queue cache misses went up:

Object	Instance	Counter	Value
Physical Disk	D: (TCOSS)	Disk Writes/sec	103
		Disk Write Bytes/sec	632,000
		Disk Reads/sec	14.4
		Disk Read Bytes/sec	187,000
		%Disk Write Time	67
		%Disk Read Time	6.3
TCOSS Cache	Database	Cache Misses/sec	0
	Directory	Cache Misses/sec	1.3
	Document	Cache Misses/sec	13.1

Database cache misses were about 2 per second at the beginning of the test and then decreased to zero, independent of the outbound queue length, because all the configured 50,000 mail entries fit into the database cache.

5.9.6 Test Results: TC/Web User Access Simulation

The “WAPT” load and stress testing tool was used to test simultaneous access by 50 web users. The 50 users did a number of pre-recorded operations (login, list inbox, open message from inbox etc.) without any delay in between.

During this test the fax work flow as in “Test with 2-page messages and increased TCOSS cache” above was also running, the outbound fax queue length was between 100 and 500 so the TCOSS cache worked efficiently.

Object	Instance	Counter	Value without users	Value with 50 users
Processor	_Total	% Processor Time (0 ..100)	33	62
Process	TCOSS	% Processor Time (0 ..400)	32	47
	w3wp	% Processor Time (0 ..400)	0.3	105
		Private Bytes	65,000,000	614,000,000
Memory		Committed Bytes	2,910,000,000	3,420,000,000
Physical Disk	D: TCOSS)	Disk Writes/sec	104	116
		Disk Write Bytes/sec	640,000	700,000
		Disk Reads/sec	1.9	2
		Disk Read Bytes/sec	2000	2.300
		%Disk Write Time	67	78
		%Disk Read Time	1	1.1

The increase in CPU usage is mostly caused by the IIS worker process “w3wp” which handles the web server requests. TCOSS CPU usage also increases to 47% (on a scale from 0 to 400).

6. IPv6 Protocol

6.1 Introduction

IPv6 protocol is the successor of the well-known IPv4 protocol which is being used in the Internet nowadays. It was defined in December 1998 by IETF in the specification RFC 2460. The necessity for better IP protocol is driven especially by the lack of address space provided by IPv4 addressing scheme. It has been predicted that in around 2011-2012 the address space of IPv4 will be completely exhausted, the large ISPs and enterprises will not get any new IPv4 addresses so they will be forced to migrate to IPv6.

6.2 IPv6 Basics

This chapter provides some basic information on IPv6 protocol, especially on its addressing syntax and conventions, but it is not a complete IPv6 guide and does not explain how to set up an IPv6 network.

6.2.1 IPv6 Address

IPv6 protocol uses 128 bit address, as opposed to 32 bit address in the IPv4. While IPv4 addresses are presented in the *dotted-decimal* form of four decimal numbers separated by period (.) character, IPv6 uses hexadecimal representation of 16-bit boundaries (of the 128 bit address) separated by colons (:). This is being referred to as *colon hexadecimal* representation.

Leading zeros in a hexadecimal group may be omitted but also several consecutive all-zero groups may be replaced by two colons (::).

```
Example of three valid representations of the same IPv6 address:
2001:0db8:00a3:0000:0000:0001:2345:1234 'full format
2001:db8:a3:0:0:1:2345:1234                 'suppressed leading zeros
2001:db8:a3::1:2345:1234   'suppressed consecutive all-zero groups
```

Each IPv6 address consists of 64-bit network part referred to as *IPv6 prefix* and 64-bit *interface identifier*. Prefixes for IPv6 networks are expressed in the same way as Classless Inter-Domain Routing (CIDR) notation for IPv4, which is the *address/prefix-length* notation.

For example, the IPv6 prefix for the IPv6 address above is:

```
2001:db8:a3::/64
```

and in the fact it stands for the contiguous IPv6 address range

```
2001:db8:a3:0:0:0:0:0 - 2001:db8:a3:0:ffff:ffff:ffff:ffff
```

With IPv6 unicast addresses (see below) the prefix length is always 64, so there is no need to write the prefix length along with the IPv6 address. This implies that there are no masks being used with IPv6 addresses, as opposed to IPv4 masks which are necessary due to variable network/host portion of each IPv4 address.

6.2.2 IPv6 Address Types

There are three types of IPv6 addresses: unicast, multicast and anycast.

Unicast IPv6 address is an address for a single interface.

Multicast IPv6 address is an address for a set of interfaces and a packet sent to such an address will be delivered to all interfaces identified by this address.

Anycast IPv6 address is also an address for a set of interfaces, but a packet sent to such an address is delivered to one of these interfaces.

6.2.3 IPv6 Address Scope

IPv6 addresses have a scope which defines a network area over which they are defined and relevant.

There are following main address scopes for unicast addresses (which are of the main KCS interest):

Name	Scope	Identified by	Example
Global Address	Global	First three bits equal to 001	2001:db8:a3::1:2345:1234
Unique Local Address	Site-Local	Start with the prefix fd00::/8	fd96:eb5f:7508:5760:204:23ff:feac:4172
Site-Local Address	Site-Local	Start with the prefix fec0::/10	fec0:eb5f:7508:5760:204:23ff:feac:4172
Link-Local Address	On-Link Neighbors	Prefix fe80::/64	fe80::204:23ff:feac:4172

6.2.4 Special IPv6 Addresses

Address	Purpose
::0/128	Address with all zero bits is called “unspecified address” (corresponds to 0.0.0.0 in IPv4)
::1/128	Loopback address (corresponds to 127.0.0.1 in IPv4)

6.2.5 IPv6 Address and the Port Number

IPv6 uses the same concept of *ports* as IPv4 does, including the same well-known ports, but if writing IPv6 address and the port number in one string, it is necessary to quote the address with “[]” brackets like here:

```
[2001:db8:a3::1]:443
```

“[]” brackets must be also used when writing an IPv6 address in a URL like here:

```
http://[2001:db8:a3::1]/index.html
```

6.2.6 Assignment of IPv6 Addresses

It is possible to assign IPv6 addresses through auto-configuration but also manually. The simplest automatic approach is so called *stateless address configuration* where IPv6 hosts can configure themselves automatically when connected to a network with IPv6 enabled router by the means of the *Network Discovery protocol* (ND).

Once connected to the network, the host sends so called link-local multicast router solicitation request and the router responds with a router advertisement packet which contains a couple of network configuration parameters, the most important is the address prefix.

Having received the IPv6 address prefix from the router, IPv6 host generates its interface identifier in order to generate the full IPv6 address. Usually the interface identifier would be based on the network interface's MAC address (using so called EUI-64 address format which maps the 48-bit MAC address into 64-bit interface identifier), but there is also a possibility that the host would use randomly generated permanent interface identifier in order to mitigate address scans of unicast IPv6 addresses on a subnet.

By default, Windows Server 2008 and Windows 7 use the randomized approach, but it can be disabled by the following netsh command:

```
Netsh interface ipv6 set global randomizeidentifiers=disabled
```

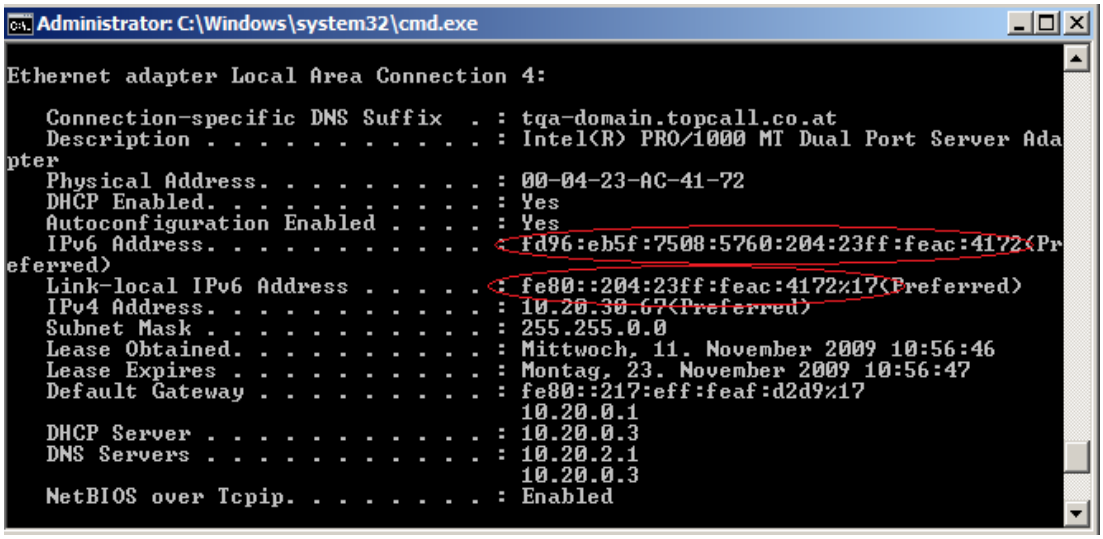
Having executed this command, Windows Server 2008 and Windows 7 would generate interface identifier based on the interface's MAC address.

6.3 Example: Setting Up IPv6 Cisco Router

```
Assume a subnet with a Cisco router 28xx with IOS version 12.4T(22) or later which
is configured to advertise IPv6 prefix FD96:EB5F:7508:5760::/64 over its interface
GigabitEthernet 0/1:
! Global settings

Ipv6 unicast-routing

! Interface related settings

interface GigabitEthernet0/1
 no ip address
 duplex auto
 speed auto
 ipv6 address FD96:EB5F:7508:5760::/64 eui-64
```

Each Windows Server 2008 or Windows 7 IPv6 host (on both of these operating systems IPv6 is enabled for auto-configuration by default) connected to the same subnet will be assigned the IPv6 address with this prefix.

If the calculation of the interface identifier based on the MAC address has been enforced by the corresponding netsh command, the inspection of the assigned IPv6 address on the corresponding interface through ipconfig /all command will show the following:



The interface has the following IPv6 addresses assigned:

1. unique-local address fd96:eb5f:7508:5760:204:23ff:feac:4172
   Its interface identifier **2**04:23**ff**:**fe**ac:4172 is the EUI-64 representation of the MAC address 00-04-23-AC-41-72
   (the 16 bit sequence fffe is being inserted per EUI-64, the highest octet of the MAC address 00 has been converted to 02 due to the fact that the Universal/Local bit in the highest octet of the MAC address is per EUI-64 complemented, in this case from 0 to 1)
2. link-local address fe80:: 204:23ff:feac:4172
   The link-local address has been generated automatically by the Windows 2008 / Windows 7 without any router intervention.

6.4 IPv4 to IPv6 Migration Scenarios

Prior to KCS version 9.0, KCS product family has been using only IPv4 protocol stack as for the TCP/IP communication for own inter-module connectivity but also for interconnections with external products. But in the world the migration to IPv4's successor – the IPv6 protocol stack – has already begun.

It is obvious that it is not possible to upgrade huge IPv4 based networks for IPv6 in one step (neither public Internet nor large private networks) and therefore most enterprises will start performing the transition from IPv4 towards IPv6 in a step by step manner.

There are three typical strategies how an enterprise can go for IPv6.

6.4.1 Scenario 1: Dual-Stack Network

Administrators start to equip their network nodes (host computers, routers, gateways) with the IPv6 protocol stack and thus making them IPv4/IPv6 enabled nodes. Each node will be assigned both IPv4 and IPv6 addresses on the same network interface. IPv4/IPv6 enabled applications may communicate with each the other via either IPv4 or IPv6 protocol. After all network nodes have been IPv6 enabled, the IPv4 support could be eventually switched off, making the networks IPv6 only one.

The obvious disadvantage of this scenario is the necessity of having both IPv4 and IPv6 routing intact and this making the network very complex.

6.4.2 Scenario 2: Adding IPv6 Infrastructure

Administrators leave their IPv4 network as it is but start adding IPv6 sub-networks, for example, by starting to replace the network equipment of chosen subsidiaries. These IPv6-only sub-networks will be then interconnected through the IPv4 networks using any of IPv6 through IPv4 tunneling techniques like 6to4, ISATAP.

6.4.3 Scenario 3: IPv6 only Network

Having started to implement the Scenario 1 or 2, the final goal is clearly the IPv6 only network. All nodes in the networks which could be IPv6 enabled communicate via IPv6 only but they can't reach IPv4 nodes which could not be equipped with IPv6 for any reason (old applications not supporting IPv6, old OS, running on the old hardware etc).

In order to enable also communication between IPv6 only and IPv4 only nodes, so called translation techniques are being used to convert IPv6 packets into IPv4 ones.

There are many such techniques operating on different layers (application, transport, network) for example the NAT-PT (Network Address Translator, Protocol Translator) network layer technique directly converting IPv6 packets into IPv4 independently from the applications.

6.5 KCS IPv6 Support

6.5.1 Basic Strategy

Starting with KCS release 9.0, the migration towards IPv6 protocol has begun with the following final goals:

1. The IPv6 connectivity for KCS applications is supported on Windows Server 2008 and later (link and server components) and Windows 7 (client applications) only.
   However, the same binary code of each IPv6 enabled application will continue to work in IPv4 mode on each supported older operating system.

2. The KCS Server applications (like TCOSS.EXE, TWS) are able to accept client connections through IPv4 and IPv6 simultaneously

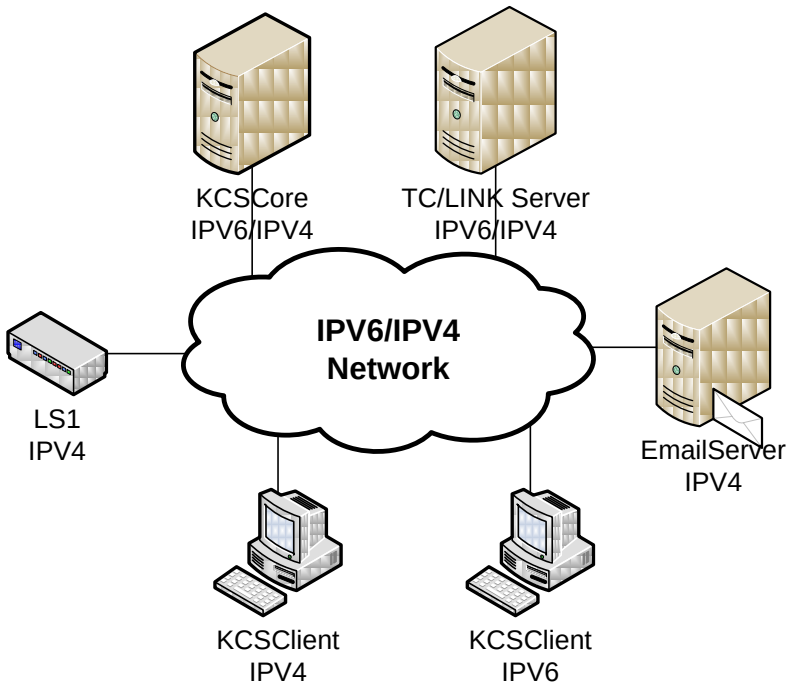
3. The KCS Client applications are able to connect to their corresponding servers through both IPv4 and IPv6

The KCS version 9.0 is the first step towards IPv6 support, but it does not include IPv6 support for all applications/modules.

In the chapter *Security Strategy – Network,* there is a table with all supported TCP/UDP connections. Please refer to the column "IPv6 enabled" for the information, which connectivity has already been enabled for IPv6 and starting with which KCS version.

6.5.2 KCS Support for Dual-Stack Network

Those KCS applications/modules which have already been IPv6 enabled may use either IPv4 or IPv6 protocol in the IPv6/IPv4 enabled network:



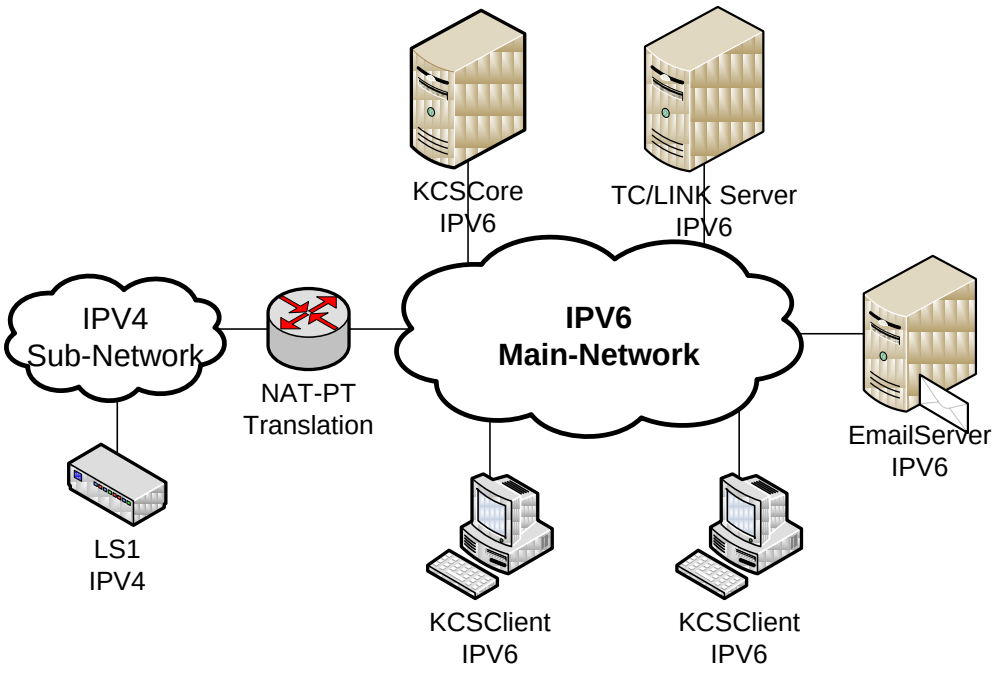
In this way administrators may perform the migration towards IPv6 step by step, for example starting by IPv6 enabling of the servers, and then adding IPv6 for related client applications.

6.5.3 KCS Support for IPv6 Only Infrastructure

All IPv6 enabled KCS applications/modules may be used also in the IPv6 only network, except for KCS hardware which supports IPv4 protocol only (the Mod 305 LS1, TC15, …)

Due to the incompatibility between IPv4 and IPv6, the IPv6-only hosts cannot directly talk with IPv4 applications. This is where the so-called IPv6 to IPv4 translation techniques step in.

Several translation techniques exist, but the most popular and commonly available on Cisco routers is the NAT-PT (Network Address Translation – Protocol Translation) standardized by IETF in the RFC 2766:



There are the following requirements to implement NAT-PT on a Cisco router in order to integrate KCS IPv6-only Windows applications with KCS IPv4-only hardware boxes:

1. Create a dedicated or choose an available IPv4 sub-network in the geographical location where KCS hardware boxes are located and connect them to this sub-network
2. Choose one of the available Cisco routers with IOS version 12.4T(22) or later (being connected to the customer's main IPv6 only network), equip it with a dedicated LAN interface and connect this interface to our IPv4 sub-network.
3. Configure the NAT-PT translation between IPv6 and IPv4 interfaces on the Cisco router

Cisco provides very detailed documentation for NAT-PT configuration, for example here:

http://www.cisco.com/en/US/docs/ios/ipv6/configuration/guide/ip6-nat_trnsln_ps6350_TSD_Products_Configuration_Guide_Chapter.html

6.5.4 Cisco 28xx Router NAT-PT Configuration

Let's assume that KCS core server (TCOSS) in the IPv6 only network should connect to the LS1 in the IPv4 only network. Both networks are interconnected through Cisco 28xx router.

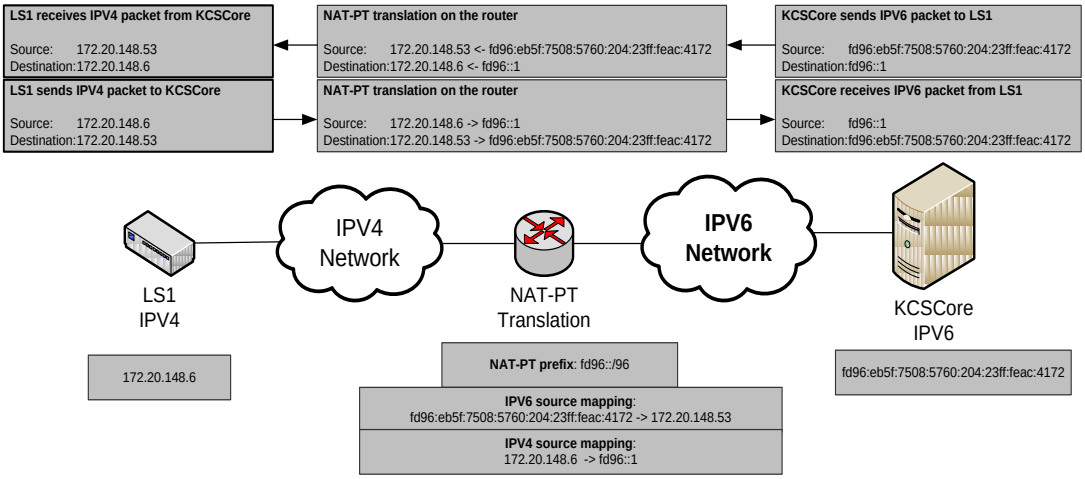
Relevant configuration parameters are:

1. KCS core has IPv6 address fd96:eb5f:7508:5760:204:23ff:feac:4172
2. LS1 server has IPv4 address 172.20.148.6
3. The router has NAT-PT prefix fd96::/96 configured
4. The router maps the source address 172.20.148.6 to fd96::1
5. The router maps the source address fd96:eb5f:7508:5760:204:23ff:feac:4172 to 172.20.148.53

How NAT-PT works on the Cisco router:

1. In order to send a packet to the LS1, KCS core has to send it to its IPv6 “proxy address” FD96::1 (the IPv6 network must take care that this packet would be routed to the appropriate NAT-PT router’s interface)
2. The router recognizes the prefix fd96::/96 in the packet’s destination address and executes the NAT-PT translation for this packet (due to NAT-PT prefix configuration)
3. Based on the IPv4 and IPv6 source mapping configuration, it replaces the destination IPv6 address fd96::1 by the 172.20.148.6 and the source address fd96:eb5f:7508:5760:204:23ff:feac:4172 by its IPv4 “proxy address” 172.20.148.53
4. The packet is delivered to the IPv4 address 172.20.148.6

Overview:



Corresponding Cisco router 28xx configuration using static NAT-PT:

Static NAT-PT mapping is quite simple and understandable, but requires one configuration line per IPv6 or IPv4 host which should be involved in the NAT-PT translation
(see ipv6 nat v4v6 … and ipv6 nat v6v4 … lines below):

```
! Global settings
!
Ipv6 unicast-routing
no ipv6 cef
!
! Interface related settings
!
! IPv4 interface
interface GigabitEthernet0/0
 ip address 172.20.148.35 255.255.255.0
 duplex auto
 speed auto
 ipv6 nat
!
! IPv6 interface
interface GigabitEthernet0/1
 no ip address
 duplex auto
 speed auto
 ipv6 address FD96:EB5F:7508:5760::/64 eui-64
 ipv6 nat
 no ipv6 redirects
!
! NAT-PT configuration
ipv6 nat v4v6 source 172.20.148.6 FD96::1
```

```
ipv6 nat v6v4 source fd96:eb5f:7508:5760:204:23ff:feac:4172 172.20.148.53
ipv6 nat prefix FD96::/96
!
```

Cisco router 28xx configuration using dynamic IPv4-mapped NAT-PT:

This configuration allows each IPv6 only host to talk with any of the IPv4 only hosts by:

1. Defining the pool/range of IPv4 addresses as IPv4 “proxy” addresses for IPv6 hosts (in the example below 172.20.148.53 – 172.20.148.62 with the prefix length 24, which corresponds with IPv4 mask 255.255.255.0)
2. Configuring the NAT-PT prefix to be “v4-mapped” – it means that each IPv6 address FD96::AABB:CCDD would be translated to IPv4 address determined by last 32 bits AABB:CCDD. With our example, in order to reach LS1’s address 172.20.148.6 KCS core would send the IPv6 packet to the destination address FD96::AC14:9406

```
! Global settings
!
Ipv6 unicast-routing
no ipv6 cef
!
! Interface related settings
!
! IPv4 interface
interface GigabitEthernet0/0
 ip address 172.20.148.35 255.255.255.0
 duplex auto
 speed auto
 ipv6 nat
!
! IPv6 interface
interface GigabitEthernet0/1
 no ip address
 duplex auto
 speed auto
 ipv6 address FD96:EB5F:7508:5760::/64 eui-64
 ipv6 nat
 no ipv6 redirects
!
! NAT-PT configuration
ipv6 nat v6v4 source list nat_traffic pool ipv6_2_ipv4
ipv6 nat v6v4 pool ipv6_2_ipv4 172.20.148.53 172.20.148.62 prefix-length 24
ipv6 nat prefix FD96::/96 v4-mapped nat_traffic
!
ipv6 access-list nat_traffic
 permit ipv6 any FD96::/96
!
```

KCS core and LS1 configuration using NAT-PT:

1. Given the LS1 is properly setup to listen on particular IPv4 address (like 172.20.148.6 in the example above) there is no need to configure anything as for NAT-PT
2. In the KCS core simply configure the corresponding “proxy” IPv6 address of the LS1, instead of its IPv4 address

Common Cisco NAT-PT pitfalls:

1. NAT-PT translation is not supported in Cisco Express Forwarding (CEF).
   The CEF must be disabled by the command `no ipv6 cef` (see examples above).

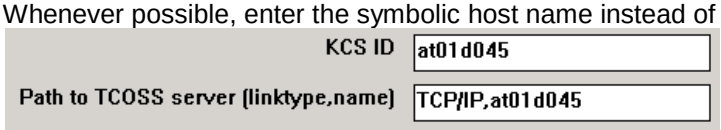
2. It may be necessary to disable IPv6 redirects on the IPv6 interface taking part in the NAT-PT by the command `no ipv6 redirects` (see examples above).

   The reason for this is unclear. However, with the dynamic NAT-PT configuration above without suppression of IPv6 redirects, the router very often (but not always) sent the ICMP6 redirect messages to IPv6 KCS core host and thus instructing it to sent its IPv6 packets to a different router which was completely wrong.

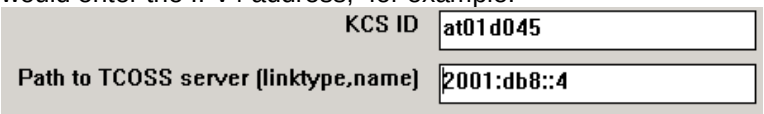
6.6 How to Set Up KCS for IPv6

Please consider following conventions when typing IPv6 addresses either during KCS setup, directly into the Windows registry or in the KCS client configuration panels.

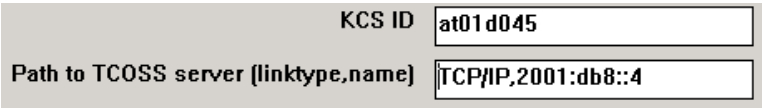
1. Whenever possible, enter the symbolic host name instead of the long IPv6 address, example:



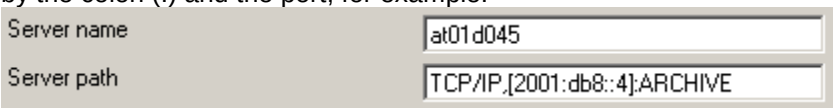
2. If necessary to enter the IPv6 address without the port number, enter it simply in the same way as you would enter the IPv4 address, for example:



   or

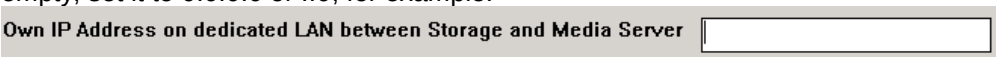


3. If necessary to enter the IPv6 address with the port number, enter it quoted with "[]" brackets followed by the colon (:) and the port, for example:



4. In the case of entering own IP address for server listeners, use following conventions:

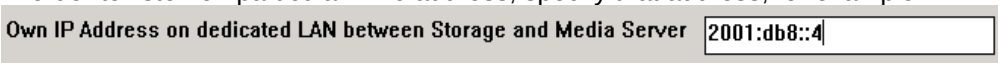
   In order to listen on all IPv4 and IPv6 addresses on all interfaces, either leave the IP address field empty, set it to 0.0.0.0 or ::0, for example:



   or

   or

   In order to listen on particular IPv6 address, specify that address, for example:



7. Configuration Examples

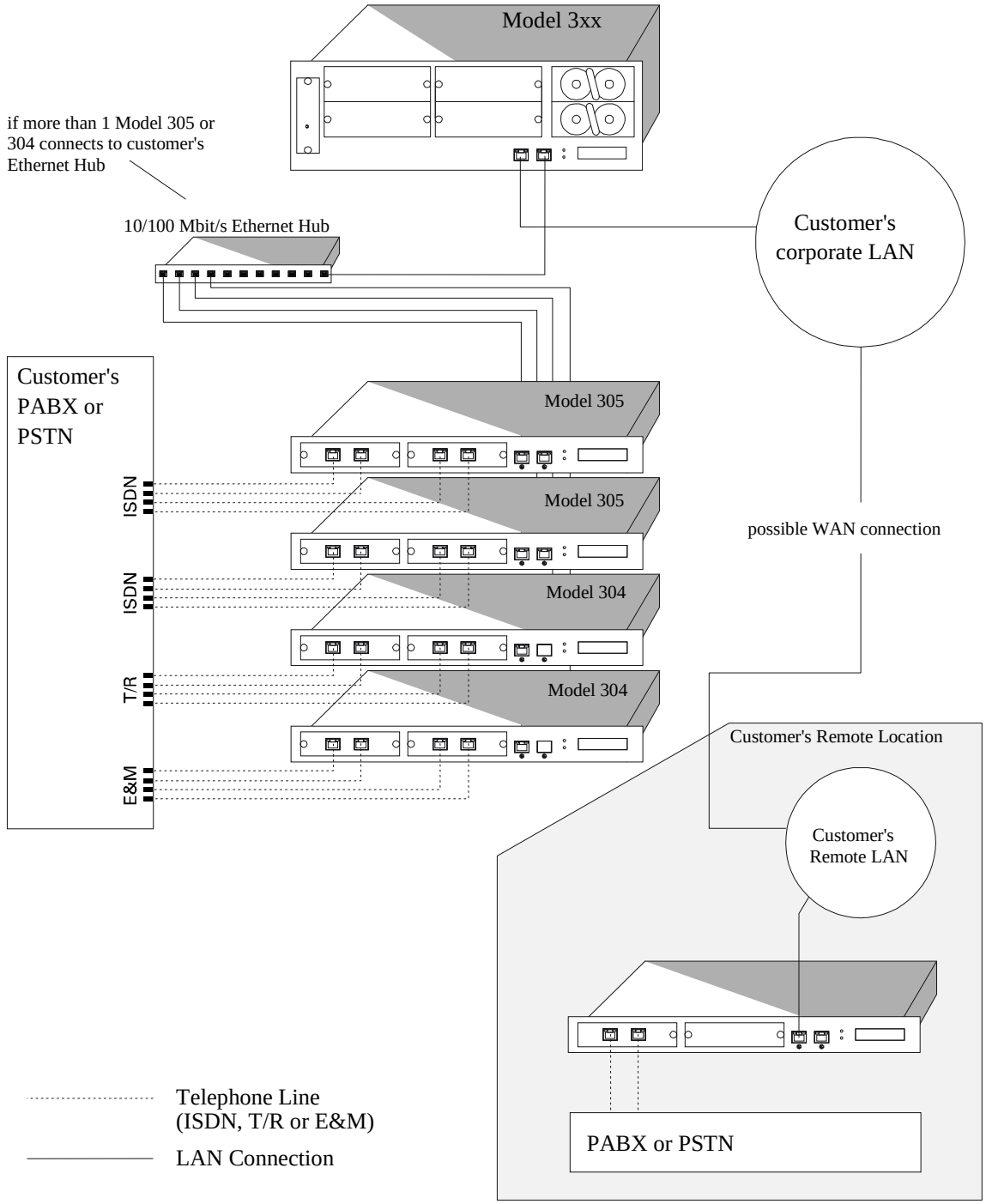
7.1 How to Configure a KCS Solution

The examples on the following pages show typical KCS hardware configurations. The optimum configuration for every single customer is planned by trained Kofax sales and technical professionals together with customer representatives.

7.1.1 FAX + VOICE via ISDN (BRI or PRI) line; FAX via Analogue (T/R or E&M) Line

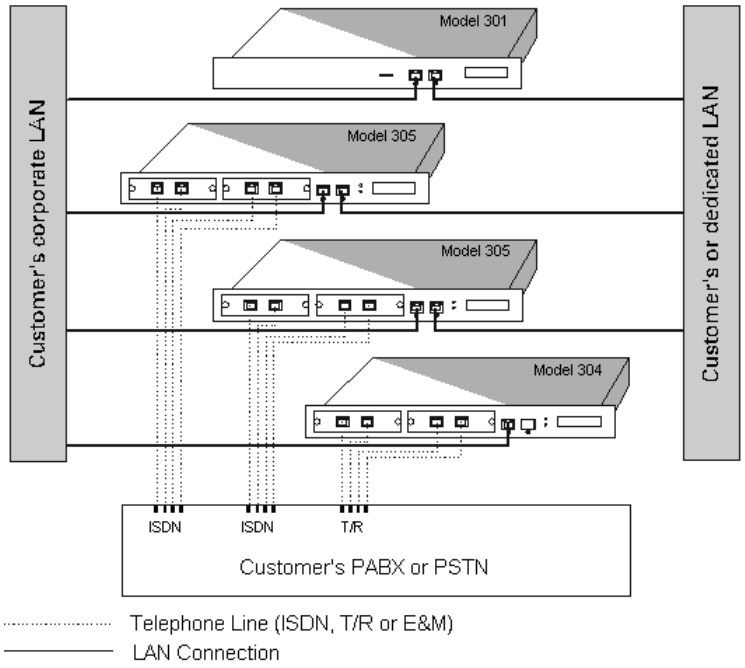
Solution with Application Server Model 300 and Line Server Models 304 and 305

Model 3xx + Model 304 (T/R + E&M Fax) or
Model 305 (ISDN BRI + PRI Fax / Voice)



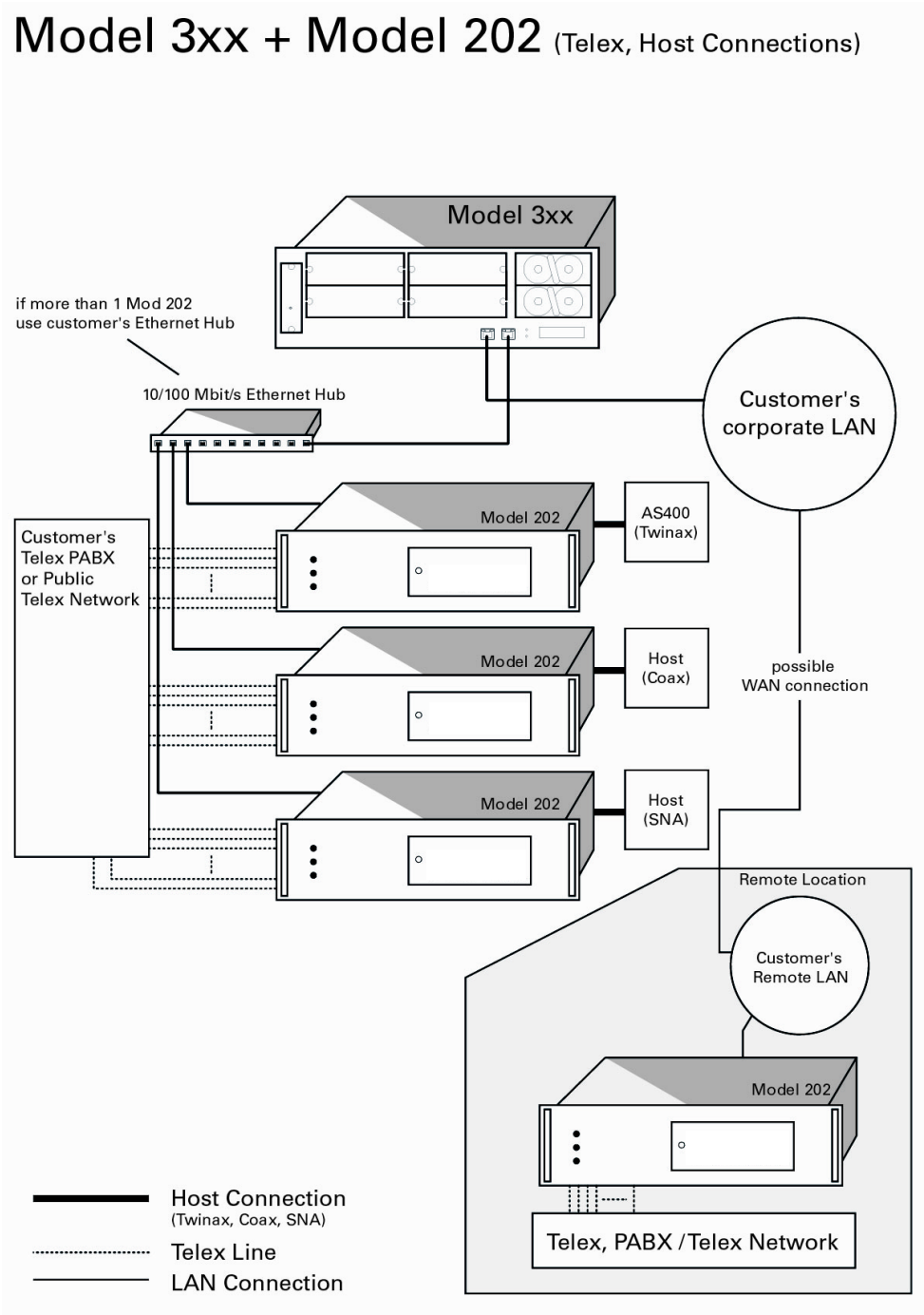
7.1.2 FAX + VOICE via ISDN (BRI or PRI) line; FAX via Analogue (T/R or E&M) Line

Entry Solution with Application Server Model 301 and KCS Models 304 and 305



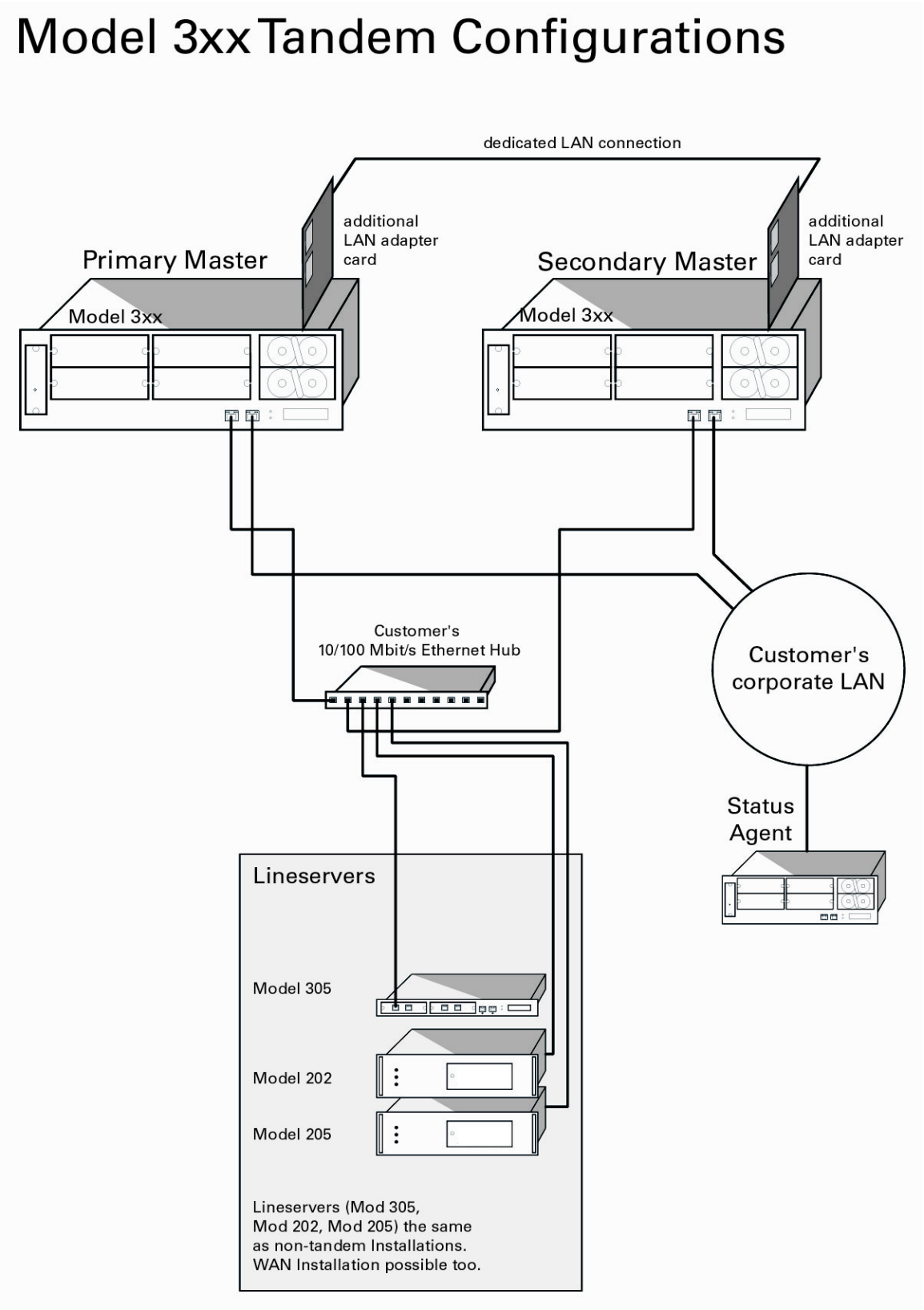
7.1.3 TELEX and Host Connections

Solution with Application Server Model 300 and KCS Model 202 LAN



7.1.4 KCS Tandem Configuration

Solution with 2 Application Servers and KCS Line Servers



7.2 How to Estimate Bandwidth Requirements and Configuration Limits

7.2.1 Bandwidth Requirements

Application Server and KCS Line Server are linked via a TCP/IP connection – either local 10/100Base/T or WAN connection in case of a BranchBox.

Line Server

Bandwidth	30kBit/s per fax channel 70kBit/s per voice or mixed fax/voice channel
Round Trip Time	200msec (260 byte block size) for up to 30 fax channels 400msec (260 byte block size) for up to 4 fax channels

BranchBox

Bandwidth	30kBit/s per fax channel
Round Trip Time	1000msec max.

Tandem Application Server (distributed system)

Entry Level Systems (up to 6 FAX lines, max. 5 client/server channels, max. 1Link):

Bandwidth > 1Mbit/sec
Packet Round Trip Time < 50msec

High End Systems (60 Fax-lines and above):

Bandwidth > 5Mbit/sec
Packet Round Trip Time < 10ms

The values given above are minimum requirements for proper operation of the Fax channels. At high system loads interactive clients such as TCfW might suffer from increased response times.

7.2.2 Configuration Limits

Application Server

LineServer/BranchBoxes:	max. 176
Fax channels:	max. 1000
Voice channels	max. 500
Number of user entries:	260.000

Line Server

Fax/voice channels:	max. 32

BranchBox

Fax channels:	4per LAN(10Base/T) connection (20 per Model 205 available, for more than 4 channels a separate KCS server is recommended)

Maximum cable length:

BRI:	Point to Multipoint 150m (500ft), Point to Point 1000m (3300ft)
PRI:	E1: 250m(820ft), T1: 35m(110ft)
E&M 2wire:	300m(1000ft)
E&M 4wire:	900m(3000ft)

7.3 Upgrade Path, Legacy Hardware

Upgrades should be exclusively done by technicians that are trained and certified by Kofax!

7.3.1 Upgrading from a Model 1xx/2xx/3xx to Model 305 or Third-Party Server

Licensing

Get new license keys for the new system. In urgent cases you may use the KCS test license keys. Note: if the system was running with a test license key before, it will refuse to work on a test license key for a certain period of time (see Chapter ‘test license keys’ in this manual).

OS and TCOSS HDDs

Draw a backup before you start any activities!

Setup new hardware with new operating system.

If the legacy system uses SCA HDDs (with just one single connector for SCSI and power supply) without a RAID controller, you may physically transfer the disk to the new system and eventually copy the data internally.

If you want to reuse the old HDD, install the appropriate driver for the new SCSI controller on the system disk before transferring the disk to the new system.

From the old system export the Registry structure and copy it to the new system. Start TCOSS setup, TCOSS will automatically detect the old configuration by the Registry.

Now transfer the TCOSS file structure via network. Remember that the only way to increase the size of the TCOSS file-structure is by copying it with TCDISK! After copying you may increase the max. File-number within the TCOSS structure and other configuration parameters with TCDISK – please see TCDISK manual for details.

Line Server

Optical link connection of legacy line servers has to be replaced by LAN connection with TS15/TC15. Remember to check the limits for the amount of lines/modules for these interfaces. Also adequate LAN/WAN bandwidth must be provided (see BranchBox Manual). Eventually you have to install additional cabinets (Model 202-LAN or Model 205-LAN).

Fax interfaces in Models 202 and older are not supported with TS15. In that case upgrade to Model 305 for ISDN BRI or to Model 205 for analogue interfaces.

ISDN PRI interfaces are not supported by TC15 - upgrade to model 305.

Third-Party Server

Read carefully the section *Third-Party Hardware Support* in this manual.

7.3.2 Component Upgrade

Upgrade CPU, RAM, HDD,

Follow instructions of the appropriate Hardware-Manual for component upgrades. This has to be done exclusively by trained Kofax technicians with components that are provided by Kofax and therefore have been tested for compatibility.

7.3.3 Software Upgrade

Follow the instructions in the documentation of the relevant module.

7.4 How to Determine System Performance

7.4.1 Performance Aspects

Each transaction creates a certain system load, as there are:

- send / receive FAX
- back reception
- client access (transmit, open, inbox, outbox)
- LAN printing
- Links and Gateways
- document conversion

Every message that gets into the system leads to one or more transactions, e.g.:

- transmitting a message from the client, possibly with scanning

- output to fax line
- back reception on the fax line
- printing of the sending copy
- delivery notification

Client systems need power to handle the user access, e.g.:

- load a template
- scanning
- search in address book
- transmit a message
- check the outbox

Some further statements:

- Systems with gateways or links have less client traffic but need power for document conversion
- back reception at fax lines doubles the load of the sending process
- returning back reception to the e-mail user doubles the load on link side
- automatic printout from KCS creates very high load
- also document conversion on links and gateways creates very high load
- the more fax lines are in use the less power is available for other jobs (priority of TCOSS)
- more RAM improves performance

7.4.2 KCS HW-Requirement Calculator

The KCS hardware requirement calculator is a Microsoft Excel sheet which determines the required hard disk speed from fax and link throughput figures and configuration options.

	A	B	C	D	E	F
1	KOFAX Communication Server HW-Requirement Calculator					
2		inbound		outbound		total
3		fax	link	link	fax	
4	number of fax lines	100			100	200
5	keep log file (0/1)	1			1	
6	route via in-action (0,1,2,..)	1				
7	sending with back-reception (0/1)				1	
8	sending with delivery notification (0/1)				0	
9	average message size in bytes	150000		150000	150000	
10	fax line usage per message in seconds	79			79	
11	average number of pages	2		2	2	
12	average page size in bytes	75000			75000	
13	peak message throughput per hour	4557	4500	10000	4557	
14	peak message throughput per second	1.3	1.3	2.8	1.3	
15						
16	database writes per message	4	4	1	7	
17	directory writes per message	6	1	2	6	
18	document writes per message	16	2	14	16	
19	disk writes per message	26	7	17	29	
20						
21	database writes per second	5	5	3	9	22
22	directory writes per second	8	1	6	8	22
23	document writes per second	20	3	39	20	82
24	disk writes per second	33	9	47	37	126
25	average disk access time in ms					8.0

The orange fields are input values. The white fields are calculated intermediate values, the result fields are blue.

The message throughput of the KCS is split up into these 4 columns:

- Inbound fax (fax line >> KCS)
- Inbound link (KCS >> link >> link-specific mail system)
- Outbound link (link-specific mail system >> link >> KCS)
- Outbound fax (KCS >> fax line)

The 4 columns are independent, but linked by the logic of the message flow. For example the inbound fax traffic and inbound link throughput are identical, if the inbound link or links work exclusively to route received faxes into a link-specific mail system.

Inbound fax (fax line >> KCS)

The main input value of the inbound fax column is the number of fax lines. If the system has a group of fax lines handling both inbound and outbound traffic (instead of dedicated inbound or outbound lines) one has to estimate the ratio of inbound to outbound traffic and split the total number of lines accordingly. Check also the reception log file configuration setting and the routing of inbound faxes via in-actions.

The 3 other input fields (“average message size in bytes”, “fax line usage per message in seconds” and “average number of pages”) have preset values which should be about right for an average installation. The “peak message throughput per hour” value is calculated from the “fax line usage per message in seconds” input value and the number of lines.

Inbound link (KCS >> link >> link-specific mail system)

The inbound link column has only one input field “peak message throughput per hour”. If for example all inbound fax messages are routed to an inbound link, the “peak message throughput per hour” figure of the inbound fax column to the left can be copied in here. If all inbound fax messages are both printed by an IP Printer and routed to a link take twice the message throughput value of the inbound fax column.

Outbound link (link-specific mail system >> link >> KCS)

The main input field of the outbound link column is the “peak message throughput per hour”. The throughput of the outbound link may be set higher than the throughput of the outbound fax lines if the link is expected to quickly put a number of messages into the KCS which are then sent out more slowly by the fax lines.

The 2 other input fields (“average message size in bytes” and “average number of pages”) may be adapted if required.

Outbound fax (KCS >> fax line)

The main input value of the inbound fax column is the number of fax lines. If the system has a group of fax lines handling both inbound and outbound traffic (instead of dedicated inbound or outbound lines) one has to estimate the ratio of inbound to outbound traffic and split the total number of lines accordingly. Check also the sending log file configuration setting and the back-reception and delivery notification sending options.

Adapt the 3 other input fields (“average message size in bytes”, “fax line usage per message in seconds” and “average number of pages”) if the preset values do not fit. The “average message size in bytes” is the size of the back-received documents, it only matters if the back-reception option is used. The “peak message throughput per hour” value is calculated from the “fax line usage per message in seconds” input value and the number of lines.

HW-Requirement Result

The result of the HW-Requirement calculation appears in the “disk writes per second” and “average disk access time in ms” fields. It is assumed here that there are no disk reads because a sufficiently large TCOSS disk cache has been configured, so the disk access time in milliseconds can be calculated from the disk writes alone.

Before selecting a hard disk based on the disk writes per second add a “safety margin” of 50-100% to the calculated figure, to allow for other use cases not taken into account by the HW-Requirement Calculator. Also the KCS should not run on 100% disk usage in peak periods.

Hard Disk Performance Figures

Usually the hard disk access time can be looked up in the hard disk specification. The access time consists of 2 parts: seek time and latency

average access time = average seek time + average latency

The average 2009 desktop hard disk has seek times of 9 or 10 milliseconds, while a fast server-grade hard disk may show seek times of 2 to 4 milliseconds. The average latency (half a revolution) can be calculated from the rotational speed of the disk:

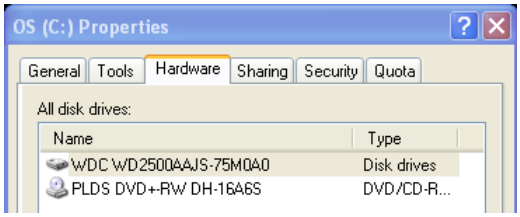
RPM	5400	7200	10000	15000
Average latency	5.6 ms	4.2 ms	3 ms	2 ms

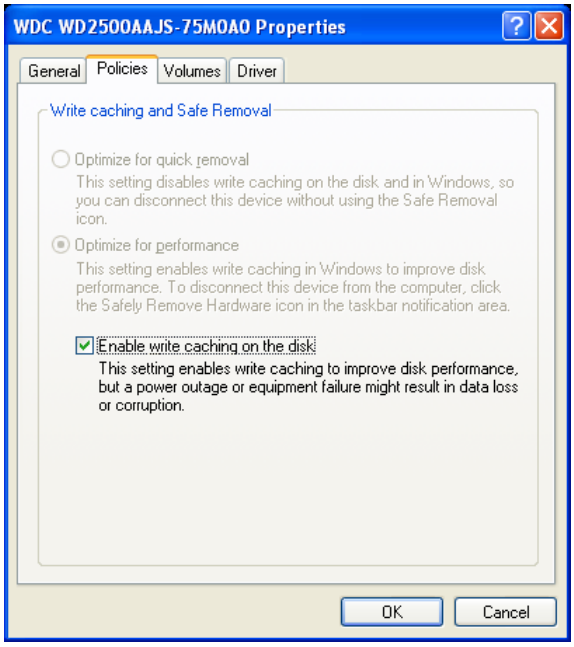
Here are some hard disk performance examples:

Hard disk	RPM	Latency	Avg seek time	Writes / sec
WD Caviar Blue 250 GB	7200	4.2 ms	8.9 ms	76
HP SAS enterprise 10000 rpm	10000	3 ms	4 ms	143
HP SAS enterprise 15000 rpm	15000	2 ms	3 ms	200

Hard Disk Write Cache

The hard disk write cache setting can be looked up under Drive – Properties – Hardware – Properties – Policies:





Enable write caching on the disk only if the KCS is connected to an uninterruptible power supply (UPS). Otherwise power failures may leave the TCOSS file system in an inconsistent state.

Write caching on the disk improves the speed of random writes considerably, for a rough estimate take a factor of 2.

HW RAID Configurations

For increased disk throughput use a HW RAID configuration in combination with battery-backed write cache on the disk controller.

It's recommended to use RAID 1+0 (mirrored sets in a striped set). Also possible is RAID 0 for each half of a tandem system. RAID 5 is not recommended, it performs poorly on random writes.

Example: A HW RAID 1+0 using a RAID controller with 512MB Battery-Backed Write Cache (BBWC) option and 8 hard disks with individual access times of 7 ms gives random write throughput figures of about 2000 writes per second. Each disk would allow 140 writes per second, so the RAID 1+0 is about 14 times faster, of which a factor of 4 can be attributed to the striping and a factor of 3.5 to the optimizations done by the RAID controller.

Hard Disk Performance Measurement

The write throughput of a given system can be measured using the TcDiskTest.exe utility. See chapter "Using TcDiskTest Tool" above for a general description.

```
C:\WINDOWS\system32\cmd.exe

08/11:21:42.429 (e94/958) tcDiskTest Started.


tcDiskTest 1.01.00, usage: [-p] [-t] [-b] [-d] [-m] [-w] [-i] [-r] [-e]

 -p : Test Cycle in ms (default: 0ms)
 -t : Test duration in seconds (default -t0 for unlimited duration)
 -b : Block size in kByte (default: 4kByte)
 -d : Logical drive to be tested (default: d:)
 -m : Min. delay to be traced (default: 100ms)
 -w : Disk writes/s monitor cycle, 0=no monitoring (default: 10s)
 -i : Testfile size in number of blocks (default: 1000000 blocks)
 -r : Read threads started (default: 0=test writes)
 -e : Delete testfile after test 0/1 (default: 1=delete)

Example: TcDiskTest -p1000 -t0 -b4 -dd -m50

C:\Tcoss\System>
```

For measuring maximum write throughput use option “-p0” for no extra delay (this is the default). Specify the drive with “-dc” (drive C) or “-dd” (drive D) and set a block size of 16 kByte using option “-b16”. Then calculate the test file size, which should be comparable to the planned TCOSS file structure size, in number of 16k blocks. The default “-i1000000” gives 1 million 16k blocks which results in a test file size of about 16 GB. Option “-e0” leaves the test file on disk after the test, this is useful for running repeated tests. The option “-t60” lets the test run for 60 seconds, default would be unlimited test duration.

Example: TcDiskTest –dc –b16 –e0 –t60

TcDiskTest starts by creating the test file “C:TcDiskTest.bin” and then reports the number of disk writes per second every 10 seconds.

```
C:\WINDOWS\system32\cmd.exe

C:\Tcoss\System>tcdisktest -dc -b16 -e0 -t60
*****************************************************
** Windows XP 5.01 Build 2600 (Service Pack 3)
** tcDiskTest ***** Tuesday, 14-Jul-2009
** Timezone:  W. Europe Standard Time [W. Europe Standard Time] +01.00 [DST = 1]

** C:\Tcoss\System\TcDiskTest.exe (858)
** created: 14/08:19:20.076 Tuesday, 14-Jul-2009
** kernel mode:        0:00:00.015
**   user mode:        0:00:00.015

14/08:19:20.092 (858/b60) tcDiskTest Started.
14/08:19:20.107 (858/b60) tcDiskTest test file size 16000000k initializing...
14/08:19:20.107 (858/b60) tcDiskTest test file created.
14/08:19:20.107 (858/b60) tcDiskTest writing 16k blocks without delay...
14/08:19:30.106 (858/b60) disk writes per second: 198, average: 198
14/08:19:40.105 (858/b60) disk writes per second: 184, average: 191
14/08:19:50.104 (858/b60) disk writes per second: 177, average: 186
14/08:20:00.103 (858/b60) disk writes per second: 179, average: 184
14/08:20:10.102 (858/b60) disk writes per second: 179, average: 183
14/08:20:20.101 (858/b60) disk writes per second: 178, average: 182
14/08:20:20.117 (858/b60) tcDiskTest Stopped.

C:\Tcoss\System>
```

The above measurement was run on a system with hard disk write caching enabled. The first value reported is a bit higher as the cache fills up, this value can be discarded.

With hard disk write caching disabled the same system showed these throughput numbers:

```
C:\WINDOWS\system32\cmd.exe
C:\Tcoss\System>tcdisktest -dc -b16 -e0 -t60
*****************************************************
** Windows XP 5.01 Build 2600 (Service Pack 3)
** tcDiskTest ***** Tuesday, 14-Jul-2009
** Timezone:  W. Europe Standard Time [W. Europe Standard Time] +01.00 [DST = 1]

** C:\Tcoss\System\TcDiskTest.exe (e7c)
** created: 14/08:33:35.838 Tuesday, 14-Jul-2009
** kernel mode:        0:00:00.000
**   user mode:        0:00:00.015

14/08:33:35.869 (e7c/cd8) tcDiskTest Started.
14/08:33:35.869 (e7c/cd8) tcDiskTest test file size 16000000k initializing...
14/08:33:35.869 (e7c/cd8) tcDiskTest test file created.
14/08:33:35.869 (e7c/cd8) tcDiskTest writing 16k blocks without delay...
14/08:33:37.369 (e7c/cd8) Disk RTT/av/max 109ms/13ms/109ms
14/08:33:45.868 (e7c/cd8) disk writes per second: 81, average: 81
14/08:33:55.884 (e7c/cd8) disk writes per second: 82, average: 82
14/08:34:05.867 (e7c/cd8) disk writes per second: 84, average: 82
14/08:34:15.883 (e7c/cd8) disk writes per second: 84, average: 83
14/08:34:25.866 (e7c/cd8) disk writes per second: 81, average: 82
14/08:34:35.866 (e7c/cd8) disk writes per second: 82, average: 82
14/08:34:35.881 (e7c/cd8) tcDiskTest Stopped.

C:\Tcoss\System>_
```

Remember that hard disk write caching requires an uninterruptible power supply (UPS).

Also do not forget to clean up the test file “C:TcDiskTest.bin” or “D:TcDiskTest.bin” after finishing the throughput tests.

7.4.3 Link Performance Measures

This section shows typical values of Link performance with no other load on the Server.

TC/LINK-FI:

Test Description	Pages/hour	Messages/hour	sec/msg
T1. Text msg 1P Mail -> TC	13242,6	13242,6	0,27
T2. TCDC Word 1P Mail -> TC	429,6	429,6	8,38
T3. TCDC Word 100 P Mail -> TC	3546,8	35,5	101,50
T5. Bin Att (105K) Mail -> TC	4439,5	4439,5	0,81
T6. Bin Att (1.14M) Mail -> TC	37771,5	377,7	9,53
T7. FAX TIF 1P TC -> Mail	3096,8	3096,8	1,16
T8. FAX TCI 1P TC -> Mail	29580,9	29580,9	0,12
T8. FAX TCI 1P TC -> Mail	29173,4	29173,4	0,12
T9. Text msg 1P TC -> Mail	72000,0	72000,0	0,05
T10. Bin Att (105K) TC -> Mail	54878,0	54878,0	0,07
T11. Bin Att (1.14M) TC -> Mail	99310,3	993,1	3,63

Tested with KCS Model 300, 2xP3/1,4GHZ, 512MB RAM, no other load

TC/LINK-LN:

Test Description	Pages/hour	Messages/hour	sec/msg
T1. Text msg 1P Mail -> TC	19047,6	19047,6	0,19
T2. TCDC Word 1P Mail -> TC	486,3	486,3	7,40
T3. TCDC Word 100 P Mail -> TC	11566,3	115,7	31,13
T4. TCDC RTF 1P Mail -> TC	790,9	790,9	4,55
T5. Bin Att (105K) Mail -> TC	12257,4	12257,4	0,29
T6. Bin Att (1.14M) Mail -> TC	196936,5	1969,4	1,83
T7. FAX TIF 1P TC -> Mail	8141,1	8141,1	0,44
T9. Text msg 1P TC -> Mail	8565,3	8565,3	0,42
T10. Bin Att (105K) TC -> Mail	7971,7	7971,7	0,45
T11. Bin Att (1.14M) TC -> Mail	275932,5	2759,3	1,30

Tested with KCS Model 300, 2xP3/1,4GHZ, 512MB RAM, no other load

TC/LINK-MQ:

1 Single page text message: 2000 messages/hour

Tested with Model 2xx.

TC/LINK-MX:

Test Description	Pages/hour	Messages/hour	sec/msg
T1. Text msg 1P Mail -> TC	9000,0	9000,0	0,40
T2. TCDC Word 1P Mail -> TC	410,5	410,5	8,77
T3. TCDC Word 100 P Mail -> TC	3755,5	37,6	95,86
T4. TCDC RTF 1P Mail -> TC	611,1	611,1	5,89
T5. Bin Att (105K) Mail -> TC	3480,6	3480,6	1,03
T6. Bin Att (1.14M) Mail -> TC	31603,9	316,0	11,39
T7. FAX TIF 1P TC -> Mail	4881,4	4881,4	0,74
T8. FAX TCI 1P TC -> Mail	4013,8	4013,8	0,90
T9. Text msg 1P TC -> Mail	7407,4	7407,4	0,49
T10. Bin Att (105K) TC -> Mail	9000,0	9000,0	0,40
T11. Bin Att (1.14M) TC -> Mail	115792,9	1157,9	3,11

Tested with KCS Model 300, 2xP3/1,4GHZ, 512MB RAM, no other load

TC/LINK-SC:

Test Description	Time measured (ms)	Messages/hour	sec/msg
T1. Text msg 1P Mail -> TC	4000	9000,0	0,40
T2. TCDC Word 1P Mail -> TC	75000	480,0	7,50
T3. TCDC Word 100 P Mail -> TC	320000	112,5	32,00
T5. Bin Att (105K) Mail -> TC	70000	514,3	7,00
T6. Bin Att (1.14M) Mail -> TC	290000	124,1	29,00
T7. FAX TIF 1P TC -> Mail	18000	2000,0	1,80
T8. FAX TCI 1P TC -> Mail	15000	2400,0	1,50
T9. Text msg 1P TC -> Mail	13000	2769,2	1,30
T10. Bin Att (105K) TC -> Mail	13000	2769,2	1,30
T11. Bin Att (1.14M) TC -> Mail	173000	208,1	17,30

Tested with KCS Model 300, 2xP3/1,4GHZ, 512MB RAM, no other load

TC/LINK-SM (valid as well for TC/Link-OC and TC/Link-SDD)

Test Description	Pages/hour	Messages/hour	sec/msg
T1. Text msg 1P Mail -> TC	39045,6	39045,6	0,09
T2. TCDC Word 1P Mail -> TC	424,3	424,3	8,48
T3. TCDC Word 100 P Mail -> TC	3265,3	32,7	110,25
T5. Bin Att (105K) Mail -> TC	3405,9	3405,9	1,06
T6. Bin Att (1.14M) Mail -> TC	48302,7	483,0	7,45
T7. FAX TIF 1P TC -> Mail	7067,1	7067,1	0,51
T8. FAX TCI 1P TC -> Mail	5074,7	5074,7	0,71
T9. Text msg 1P TC -> Mail	12420,2	12420,2	0,29
T10. Bin Att (105K) TC -> Mail	2315,6	2315,6	1,55
T11. Bin Att (1.14M) TC -> Mail	76791,8	767,9	4,69

Tested with KCS Model 300, 2xP3/1,4GHZ, 512MB RAM, no other load

TC/LINK-SJ:

HP ScanJet 5 to TC/LINK-SJ: 1 page text: 3600pages/hour

Since one ScanJet 5 has a scanning speed of 900pages/hour, a single TC/LINK-SJ can serve at least four scanners in parallel (parallel operation provided by HP ScanJet daemon)!

Tested with Model 2xx.

TC/LINK-WM:

KCS to TC/Link-WM 500messages/hour/GSM channel

Tested with Model 2xx.

7.5 How to Configure Network Interface Card Teaming

Network interface card (NIC) teaming is the process of grouping together several physical NICs into one single logical NIC

The goal of the NIC teaming services is to provide fault tolerance across a team of two or more ports on a TCOSS server.

By NIC teaming more than one physical NIC to a logical NIC, high availability of a TCOSS server is maximized. Even if one NIC (or cables) fails, the network connection does not cease and continues to operate on other NICs.

7.5.1 NIC Teaming with Intel Advanced Networking Services (ANS)

If a computer has at least one Intel NIC, the NIC teaming can be configured with Intel ANS. For download and installation see http://www.intel.com/support/network/sb/cs-009747.htm.

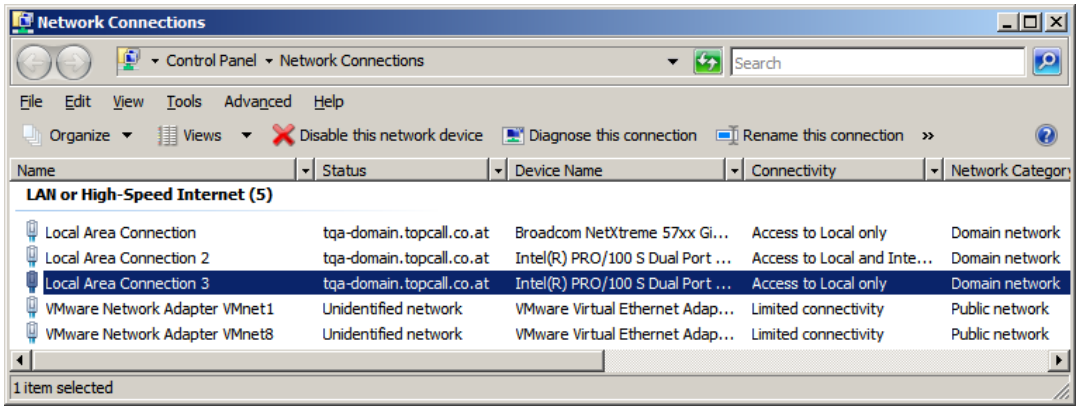
The example in this chapter can help you configuring NIC teaming with Intel.

OS: Windows Server 2008 R2

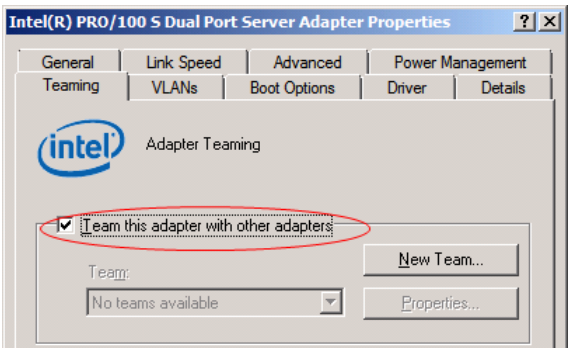
Hardware (NICs):

- BroadCom NetXtreme 57xx Gigabit Controller
- Intel® PRO/100 S Dual/Port Server Adapter

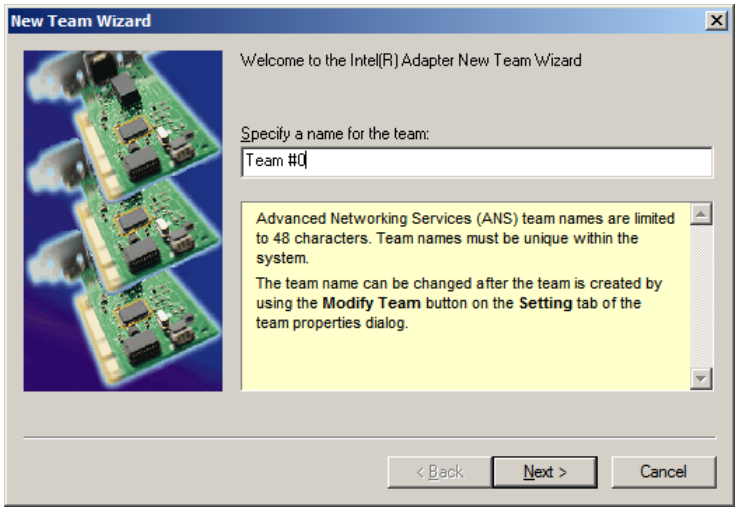
The original state of network connections without NIC teaming:



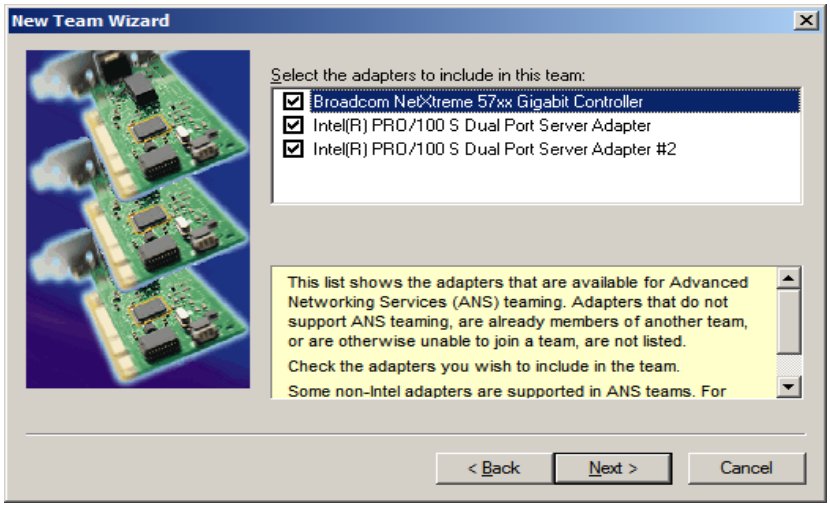
In the Properties of the Intel NIC, go to the Teaming tab and select “Team this adapter with other adapters”.



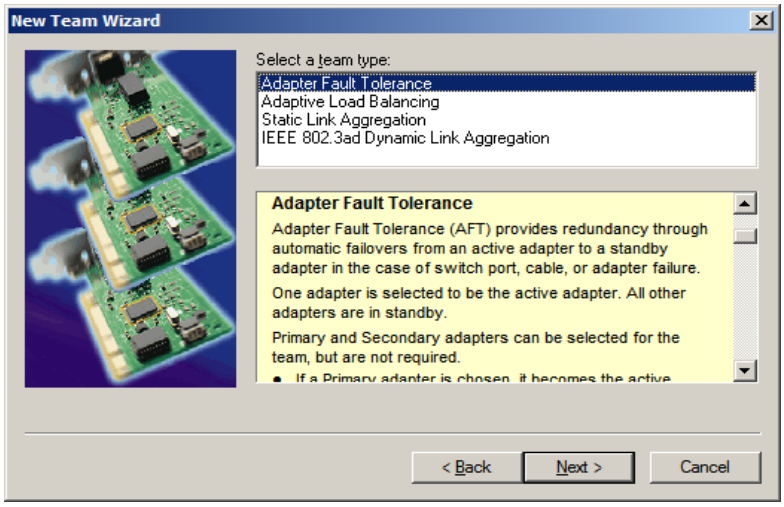
Click New Team to start a wizard that guides you through the process of creating a new team. Type a name.



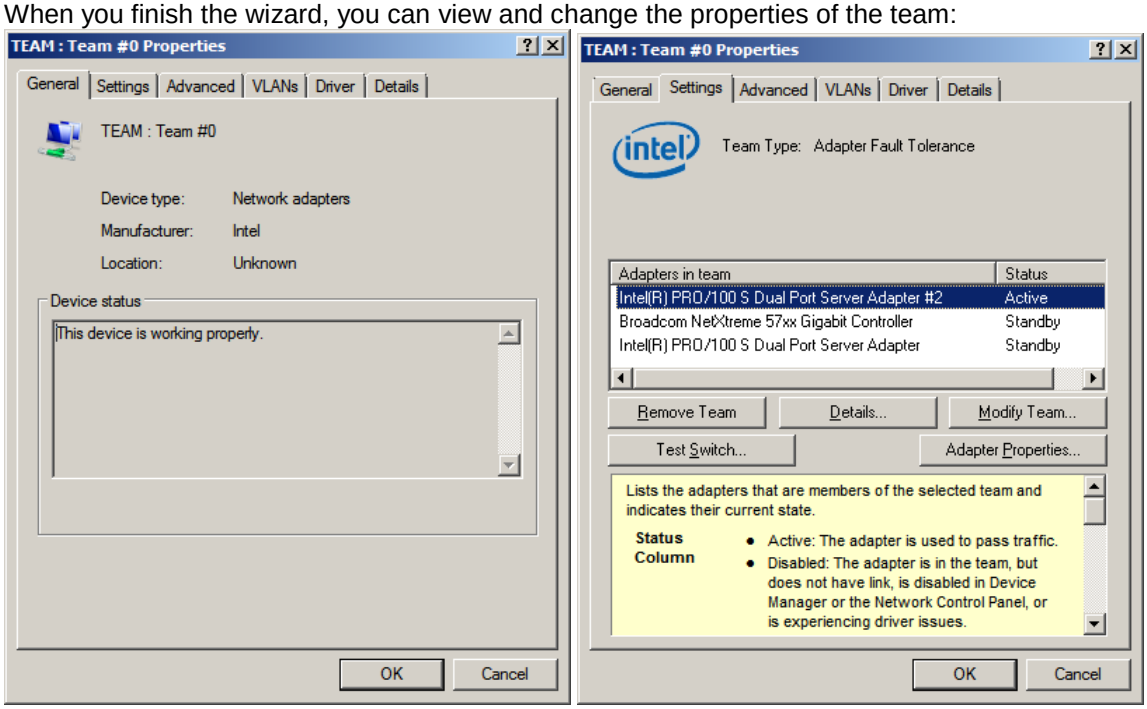
Select team members:



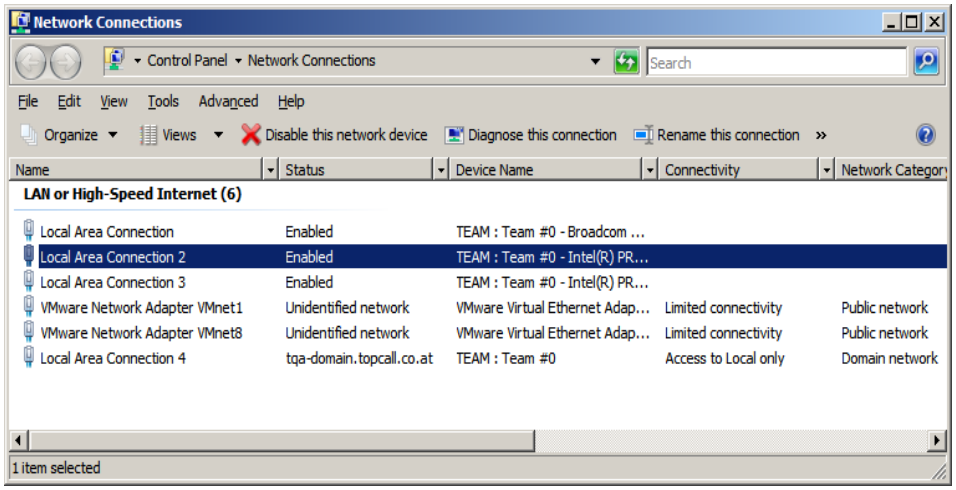
Select team type:



When you finish the wizard, you can view and change the properties of the team:



Network connections after defining a NIC team:



7.5.2 NIC Teaming with HP Networking Configuration Utility (NCU)

On computers with HP network interface cards, you can define teaming with the HP Network Configuration Utility (NCU). This tool can be found from HP webpage:
http://search.hp.com/query.html?qt=Network+Configuration+Utility

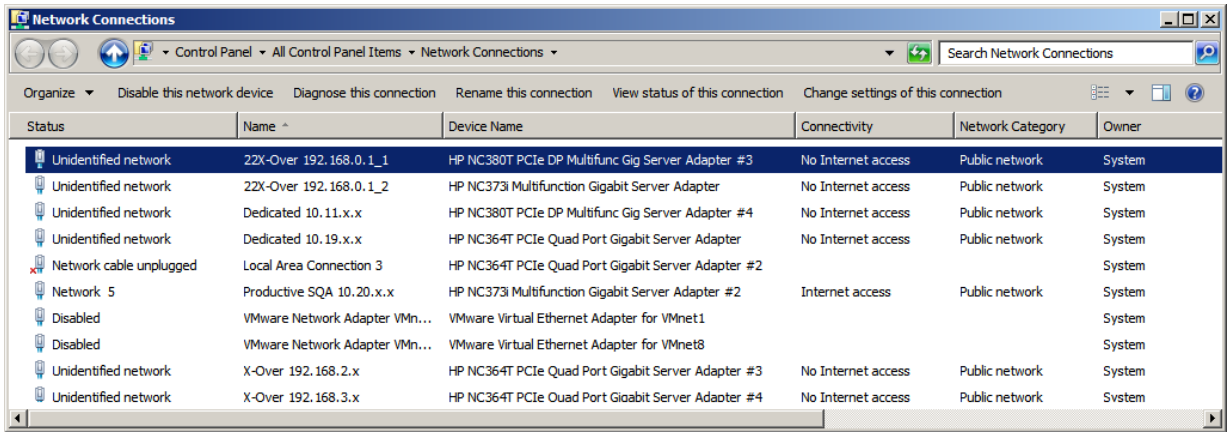
The example in this chapter can help you with configuring NIC teaming with HP.

OS: Windows Server 2008 R2

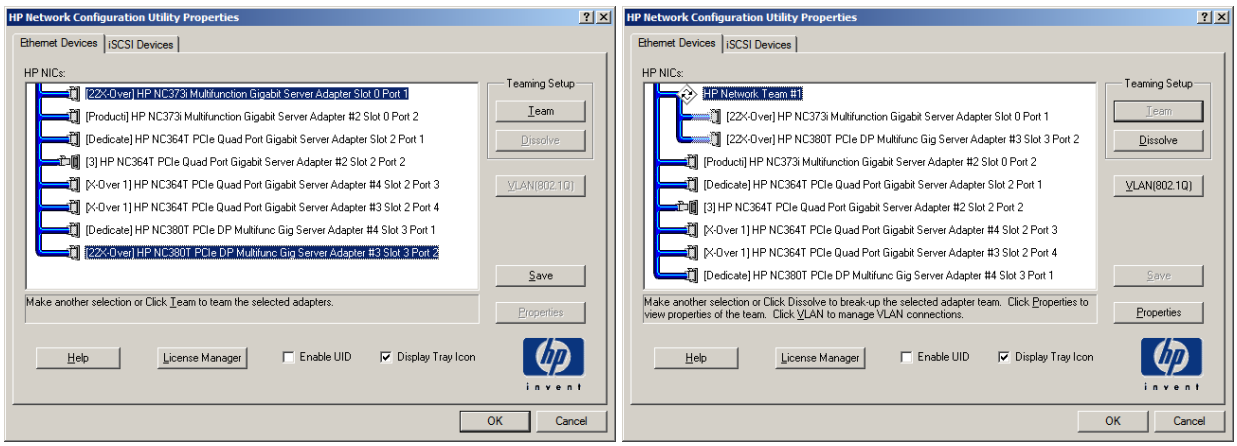
Requirements: Actual network drivers from HP for ProLiant servers and HP Network Configuration Utility for Windows Server 2008 R2 - version: 10.20.0.0 (B) (12 Jan 2011) from:

http://h20000.www2.hp.com/bizsupport/TechSupport/SoftwareIndex.jsp?lang=en&cc=us&prodNameId=3367980&prodTypeId=329290&prodSeriesId=3367979&swLang=8&taskId=135&swEnvOID=4064

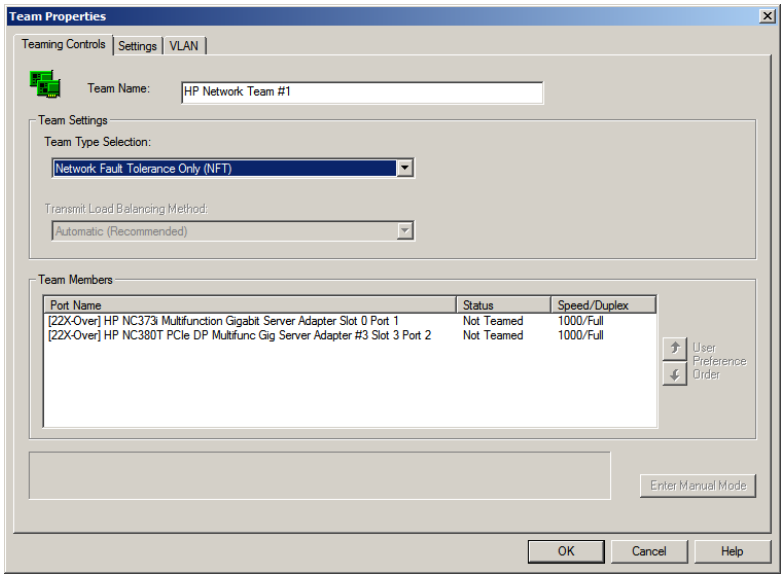
The original state of network connections without NIC teaming:



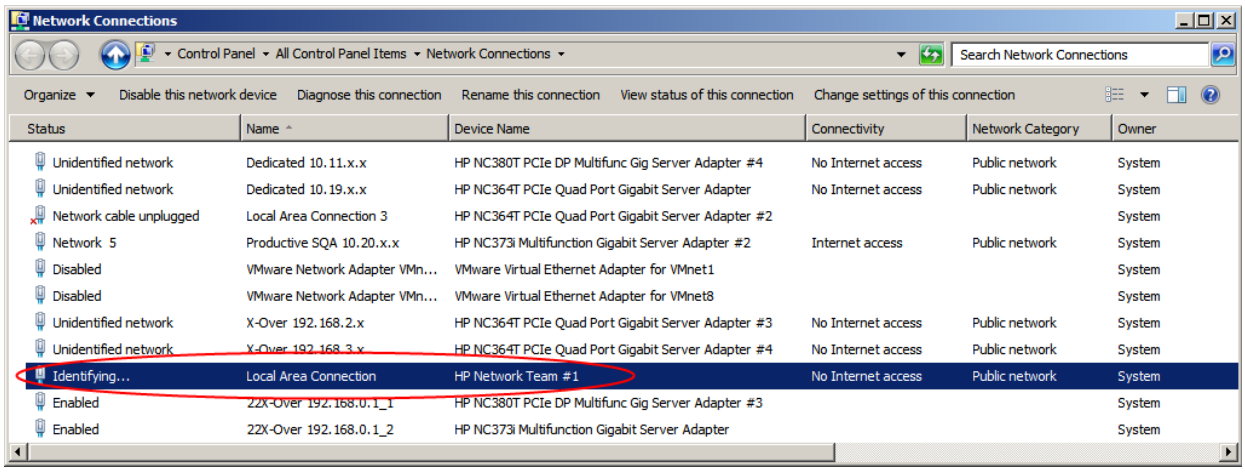
Start HP NCU. Select the members of NIC team. Click Team.



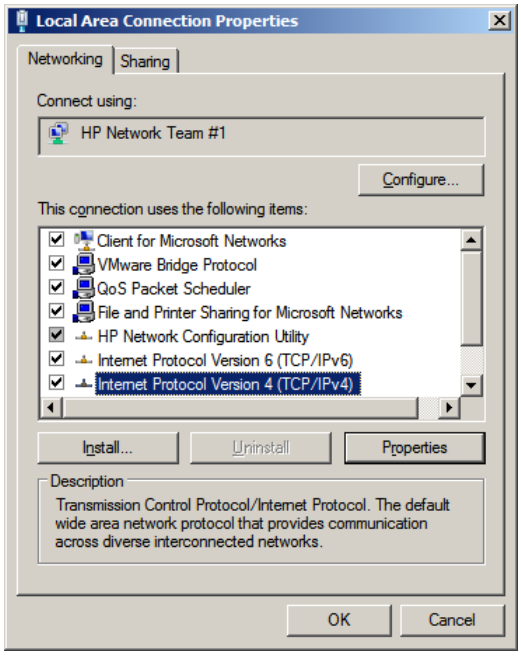
Edit the properties of the team. Click OK, then click Save.

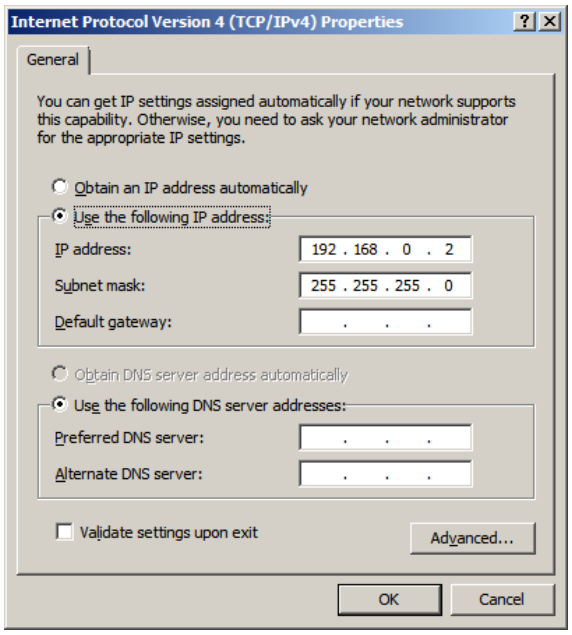


The network connections will change:

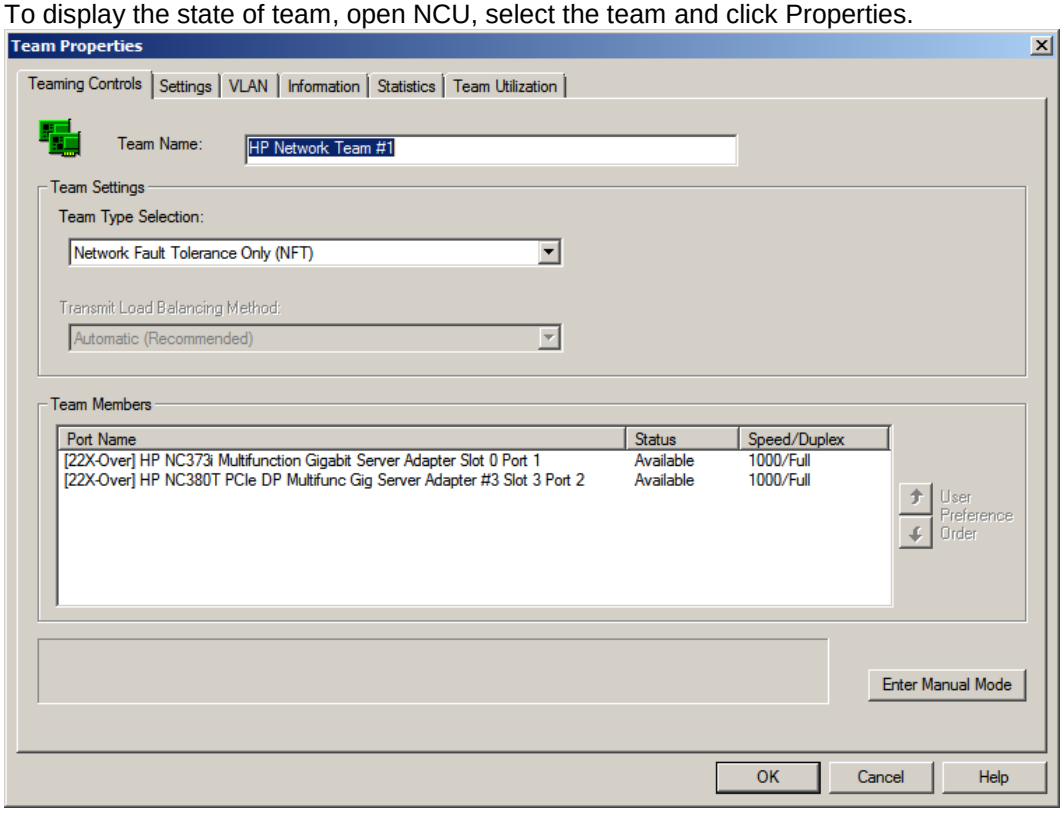


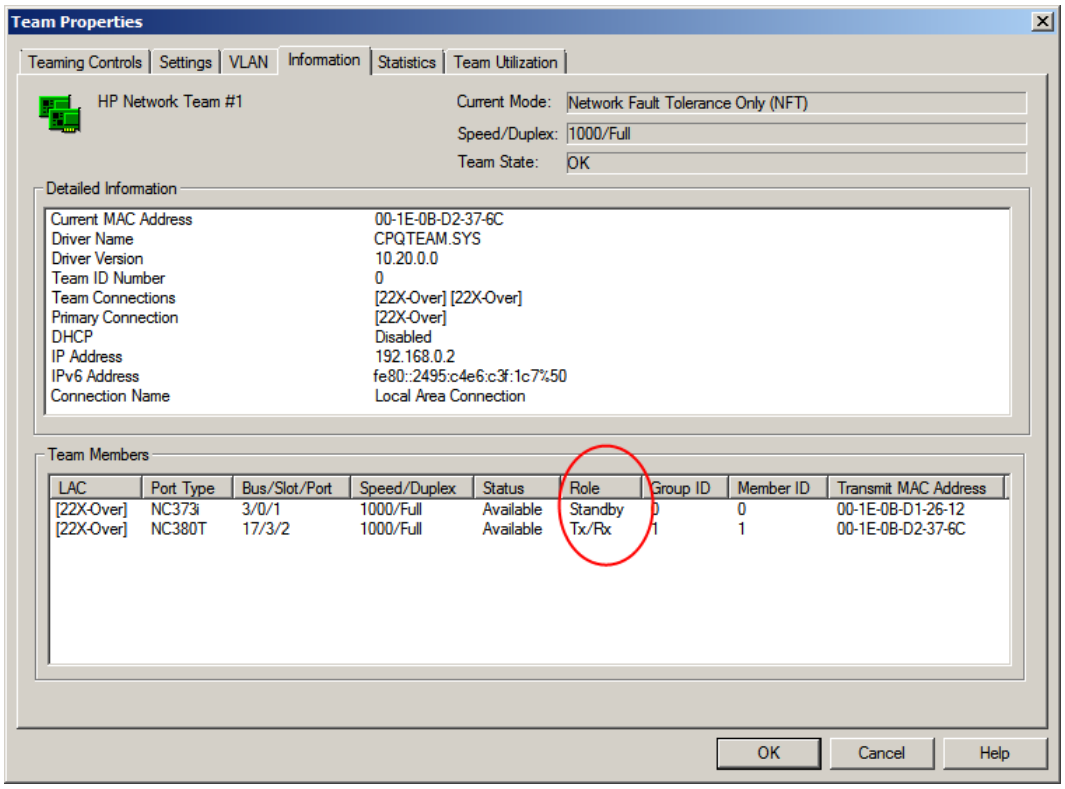
If you need to configure the IP settings manually, open the local area connection properties of defined team. Note: Close HP NCU before opening properties.





To display the state of team, open NCU, select the team and click Properties.





8. Operating and Maintaining the KCS System

8.1 Operation of Tandem Server System with Software Status Agent

In general operation of the Software Status Agent is similar to the Status Box. For details see user manuals for TCMON.

8.1.1 Recommended Power On/Off Sequence for Tandem Server

If possible, the following sequence should be used if a model 22x must be switched off or on manually. Turning off a TC means stopping TCOSS. It is not necessary to power down the system!

If a release update should be made, it is also necessary to stop TCSRV.

1.) Turn off Primary Server

2.) Turn off Secondary Server (within 100s)

3.) Turn on Secondary Server

4.) Turn on Primary Server (within 100s)

8.1.2 Failure Recovery Time Tests with Tandem Servers

Some tests have been done with a Tandem Server to give an example of how long the system is unavailable if the primary master fails and the secondary takes over and similar situations.

The Test System

A Model 300 based Tandem System was used for the tests. Primary and Secondary Server have the following characteristics.

Hardware:

- 1 x 1400 MHz CPU
- 512 MB RAM
- No RAID

OS: Windows 2000 SP4

KCS Software:

- TC/SP 7.55.07
- 1 x TCOSS
- TC/Web (only on Primary Server)
- 2 x LS1 Trace Tool (only on Primary Server)

KCS Configuration:

- 10 GB KCS File Structure
- 2 ISDN BRI Channels running in first LS1 (Booted by Primary, Secondary can take over)

- 2 ISDN BRI Channels running on second LS1 (Booted by Primary, Secondary can take over)

Test 1: Primary Server Off – Secondary Server Takes Over

The system is running in normal mode. The Primary Server has the control. The primary server gets powered off. How long does it take the secondary server to take over and the full functionality will available again?

Action completed	Time needed	Total time
Primary Server unavailable	0:00	0:00
Secondary detected problem	1:00	1:00
Secondary stopped waiting for primary	1:39	2:39
Booted from local Disk	0:25	3:04
1st Fax Channel available	0:35	3:39
Full System available	0:35	4:14

Unavailable time **4:14**.

Test 2: Secondary Server Standalone – Primary Server Comes Back

The Secondary Server has control and runs standalone (because the Primary Server is unavailable). The Primary Server is powered on again. How long does it take the Primary Server to boot up (including BIOS init and OS boot) to take over. How long is the functionality unavailable when the primary takes back control? Unavailable time is marked red.

Action completed	Time needed	Total time
Primary Server power on	0:00	0:00
BIOS initialized	0:38	0:38
OS booted	0:52	1:30
Secondary detected Primary (and restarted)	*0:15*	*1:45*
Handshake complete	*0:10*	*1:55*
Disk Update (Primary -> Secondary)	*0:41*	*2:36*
Booted from local Disk	*0:24*	*3:00*
1st Fax Channel available	*0:35*	*3:35*
Full system available	*0:35*	*4:10*

Unavailable time **2:40**.

Test 3: Secondary Server Standalone – Primary Server comes back and boots from Secondary's disk

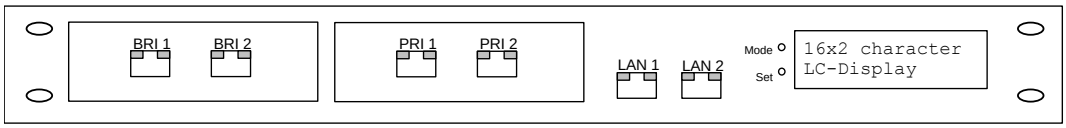
This is the same situation as in Test 3 with the difference that the Primary Server cannot access its KCS File Structure and has to boot from the Secondary Servers disk.

Action completed	Time needed	Total time
Primary Server power on	0:00	0:00
BIOS initialized	0:38	0:38
OS booted	0:52	1:30
Secondary detected Primary (and restarted)	*0:15*	*1:45*
Handshake complete	*0:10*	*1:55*
Booted from Secondary Disk	*0:27*	*2:12*
1st Fax Channel available	*0:35*	*2:47*
Full system available	*0:35*	*3:22*

Unavailable time **1:52**.

8.1.3 Operation of Line Server Model 305

Front View of LINE SERVER *Model 305*

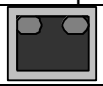


On the front side of LINE SERVER *Model 305* there are connectors to BRI/PRI and LAN lines. Each plug has 2 LEDs that indicate Status and Activity as shown in the tables below. Please note that there are slight differences between the LEDs of LS1V1 and those of LS1V2. General Status information (version, IP address and heartbeat) is shown on a LCD. 2 buttons are provided to reset the LINE SERVER *Model 305* and to setup IP-Addresses.

Find a description of Front side controls also in the Line Server Model 305 Manual!

Description of LAN LEDs on LS1V1

The LS1V1 is the old Line Server Model 305. It contains a TC16 main board and up to four TC22 modules with a DSP processing power.

Connection	Left LED	Right LED	Example
no LAN signal detected	off	off	
10 Mbps LAN connection	steadily green	flickering green to indicate activity on LAN	
100 Mbps LAN connection	steadily green	flickering yellow to indicate activity on LAN	

Description of LAN LEDs on LS1V2

The LS1V2 is the new generation of the Line Server Model 305. It contains a TC18 main board that already includes the DSP processing power.

Connection	Left LED	Right LED	Example
no LAN signal detected	off	off	
10 Mbps LAN connection	blinking green 1 sec on/off	flickering yellow to indicate activity on LAN	
100 Mbps LAN connection	steadily green	flickering yellow to indicate activity on LAN	

Description of TC23/TC24/TC26 LEDs

LED status Left Right	TC23.3	TC24	TC26
off yellow	interface reset, not yet booted, or not configured at all		
steadily red off	interface initialized, but the line not active (line disconnected or out of order)		
steadily red steadily green	interface initialized, the line is connected but not functioning properly TC24: not synchronous TC23/TC26: not used		
off steadily green	interface initialized, line connected and active		
flicker green steadily green	active transmission via this line TC26 interface only		

On device controls and display

Model 305 features a 16x2 character display and two pushbuttons on the front panel. On the LCD, various status information are displayed. The buttons are used to navigate through menus, to set the IP address, net mask and gateway of LAN1, and to reboot the device.

Startup display

On startup Model 305 displays following information:

- TC16 BIOS Version + IP-Address
- TC/LINUX Version

Afterwards you will see on the display that the Model 305 is waiting for the KCS server. As soon as TCOSS connects to the Model 305, you will get two more display screens for updating the software and for initializing the DSPs.

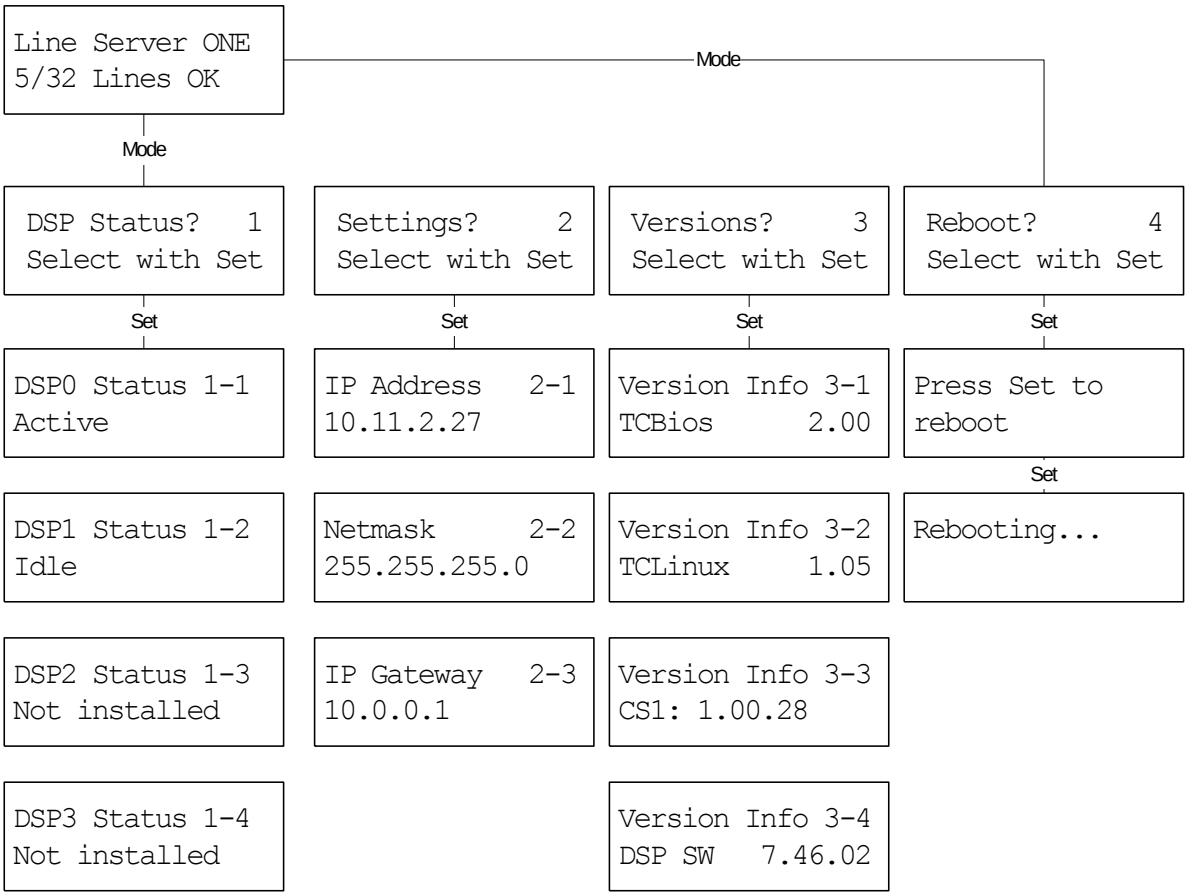
Standard display

By default Model 305 displays either ``Not connected'' followed by the IP address, or the current line statistics. Line statistics is displayed in the form ``<no of active lines>/<no of total lines>'', for example ``12/32 lines'' means that out of a total of 32 configured lines, 12 are active.

If there is no button pressed for a certain time, Model 305 will return to standard display automatically.

Menu

Pressing mode at any time (except directly after booting) brings up the menu. Pressing mode again cycles through the menu items, pressing Set selects a menu item. Pressing mode after the last menu item returns to standard display. The menu structure is outlined below:



Model 305 Menu structure

Below we describe each menu in greater detail.

DSP status

Displays the current status for each DSP. Status can be one of the following:

- Not installed: There is no TC22 module in the corresponding slot.
- Idle: The TC22 module is currently not in use. This is the status before TCOSS connects to Model 305.
- Booted: The TC22 module is loaded and running but does not process any data yet.
- Active: The TC22 module is active.
- Shut down: The TC22 module has been shut down, for example if TCOSS was disconnected.

DSP0 is the innermost module in Model 305. Press either mode or set to cycle through DSP0-DSP3. After DSP3 you return to the main menu.

Settings

Displays IP address, Net mask and default gateway. Pressing Mode cycles through the parameters, pressing set allows changing a parameter.

For IP address and gateway address, the setting starts at the tenth position of the first quad. Pressing set changes the value, pressing mode moves onto the next value. After the last position, you are asked to press set to confirm. If you press mode instead, the setting is not changed.

For the net mask, pressing set adds one-bits to the net mask, until mode is pressed. Again, you are asked to confirm the change.

Changes apply only after MODEL 305 is rebooted. You can reboot MODEL 305 from the Reboot menu (see below).

Versions

This menu displays version numbers of various software components of MODEL 305.

Reboot

When selecting reboot, you are asked to press set to confirm the choice. All ongoing activities are abandoned immediately. That implies that ongoing calls are interrupted.

It is recommended to reboot MODEL 305 only if either some setting (IP address, net mask, and the like) has changed or if the Line Server Diagnostic tool is run. Rebooting brings MODEL 305 into maintenance mode automatically.

8.1.4 Error Condition

KCS Behavior

The KCS system requires no user intervention as long as a fatal error occurs. Fatal errors are either hardware defects or multiple software hang ups.

Fax Errors

If the system recognizes a fatal error on the fax module, the following will happen:

- The whole system continues operation.
- Only the interface where the error occurred is rebooted.
- An error message file (TExxxx) is generated.

Other Errors

If the system recognizes a system error, the following will happen:

- The whole system will be restarted.
- The green LED starts to blink continuously.
- An error message is written into the Application Event Log.

Error Message Format

CHANNEL: MODULE-TEXT or MODUL-TEXT

CHANNEL	Number of the logical channel that caused the error in HEX-format. If no channel number appears, the error was generated from a module which is used from all channels.
MODULE	Name of software module that caused the error (e.g. TAM, TOS, KK99 …). If “?” is used as module name, it is not specified
TEXT	The complete error description

Error Classes

The 6 different levels are described in the table below:

Level	Short	Severity	Description	Examples

	description			
1	trace	Information	Describes situation that is caused be user activities or previous errors.	operator node reboot operator system reboot auto reboot DISK-reassign block shutdown requested
2	warning	warning	Complete System is available now, but with reduced security or for restricted time.	Disks deactivated in tandem server. Status box defective License will expire within x days
3	line out of order	error	Any module detected an error. Any channel stopped working due to wrong configuration, insufficient license and line errors.	telex/fax line out of order UAS: script not loaded license expired
4	HW/SW error corrected	error	Errors that should not occur but could be corrected (e.g. by reloading an interface)	user module timeout node n error reboot notification not generated program crc error several messages indicating "inconsistent data repaired"
5	partial stop	error	An unexpected error that could not be corrected. Parts of the system are no longer available	node stopped, link error node n channels stopped (too many error reboots)
6	system stop	error	The whole TCOSS process has been stopped.	sync stop

About Data Loss

TCOSS behaves like a database server and it is designed to work transactional. This means that all confirmed data is guaranteed to be stored permanently.

Unexpected software or hardware errors (non detected RAM errors) are the exceptions. In case of a fault tolerant system, the following hardware errors can be handled without data loss:

- Failure in the disk of either the primary or secondary master.
- Fatal hardware error in either the primary or secondary master (e.g. power supply, Power On Self Test finds a RAM error...).

8.1.5 Supervisor Advises in Case of Errors

In case an error occurs or users tell that there is something wrong with the KCS system the supervisor should perform the following tasks:

1) Do not switch off the KCS system.
2) Check the LEDs of your KCS TCOSS Server system.
3) In case the red and the green LED of the TCOSS Server are ON make sure that no further send commands are entered and that the system can execute existing ones (capacity in use goes under 80% again).
4) If the KCS system is still accessible you should check all system error messages (ATE???? Files in system folder) to locate the cause of the error.
5) In case you cannot access the KCS system start the event viewer of the NT administrative tools and check the application event log.
6) Try to solve the problem according to the error message description.
7) If you cannot solve the problem yourself report the error message to your KCS engineer.

8.1.6 Replacement of Interfaces

- Interfaces may be replaced exclusively by trained Kofax technicians.
- Line Servers can be switched off for maintenance and will reboot automatically after power on.

8.2 KCS Performance Counters

Many KCS applications provide special performance counters that can be checked by applications like the Windows Performance Monitor.

8.2.1 Background

The dynamically created KCS counters are put during runtime to the counter initialization file (if they are not already there). If the file has changed, Windows API functions will be called that equal the load counter and unload counter command-line tools (“lodctr”, “unlodctr”), and thus the new counter names are put to the registry. Additionally the memory structure is prepared to receive the counter data and to provide them to the counter data collecting applications (e.g. Perfmon).

8.2.2 Windows Server 64-Bit Version

If you use Performance Counters on 64-bit versions of Windows Server, you will have to start the service “Performance Counter DLL Host” and set it to start automatically.

If this service is not started, you cannot view the performance counters with the x64 version of Perfmon, and when trying to view them the Windows system will deactivate them also for the x32 version.

8.2.3 Counter Initialization File

The counter initialization file is put to the (hidden) “AppData” section of “All Users”, on an English Windows Server 2008 computer this is:

```
C:\ProgramData\TOPCALL\TcLib\TcLibPerf.ini
```

As the counters are created dynamically during runtime by the KCS applications, the content of the file differs for each KCS installation.

Example of the counter initialization file for a TC/LINK-FI installation (including enabled performance counters for TCSRV – “BOOTP”):

```
// Automatically created performance counter initialization file

[info]
drivername=TcLib

[languages]
009=English

[objects]
2_009_NAME=BOOTP
6_009_NAME=TCLINKFI
56_009_NAME=TCSI

[text]
```

```
2_009_NAME=BOOTP
2_009_HELP=BOOTP
4_009_NAME=Process Status
4_009_HELP=Process Status
6_009_NAME=TCLINKFI
6_009_HELP=TCLINKFI
8_009_NAME=Messages from TCOSS (total)
8_009_HELP=Messages from TCOSS (total)
10_009_NAME=Messages from TCOSS (today)
10_009_HELP=Messages from TCOSS (today)
12_009_NAME=Rejected Messages from TCOSS (today)
12_009_HELP=Rejected Messages from TCOSS (today)
14_009_NAME=Messages to TCOSS (total)
14_009_HELP=Messages to TCOSS (total)
16_009_NAME=Messages to TCOSS (today)
16_009_HELP=Messages to TCOSS (today)
18_009_NAME=Rejected Messages to TCOSS (today)
18_009_HELP=Rejected Messages to TCOSS (today)
20_009_NAME=Notifications from TCOSS (total)
20_009_HELP=Notifications from TCOSS (total)
22_009_NAME=Notifications from TCOSS (today)
22_009_HELP=Notifications from TCOSS (today)
24_009_NAME=Notifications to TCOSS (total)
24_009_HELP=Notifications to TCOSS (total)
26_009_NAME=Notifications to TCOSS (today)
26_009_HELP=Notifications to TCOSS (today)
28_009_NAME=Dirsynced Users (total)
28_009_HELP=Dirsynced Users (total)
30_009_NAME=Time in Mail DLL (msec)
30_009_HELP=Time in Mail DLL (msec)
32_009_NAME=Time in Topcall Access (msec)
32_009_HELP=Time in Topcall Access (msec)
34_009_NAME=Time in TCDC (msec)
34_009_HELP=Time in TCDC (msec)
36_009_NAME=Time in Link (msec)
36_009_HELP=Time in Link (msec)
38_009_NAME=% Time in Topcall Access
38_009_HELP=% Time in Topcall Access
40_009_NAME=% Time in Mail DLL
40_009_HELP=% Time in Mail DLL
42_009_NAME=% Time in TCDC
42_009_HELP=% Time in TCDC
44_009_NAME=% Time in Link
44_009_HELP=% Time in Link
46_009_NAME=Link Activity
46_009_HELP=Link Activity
48_009_NAME=Messages from TCOSS (last hour)
48_009_HELP=Messages from TCOSS (last hour)
50_009_NAME=Messages to TCOSS (last hour)
50_009_HELP=Messages to TCOSS (last hour)
52_009_NAME=Notifications from TCOSS (last hour)
52_009_HELP=Notifications from TCOSS (last hour)
54_009_NAME=Notifications to TCOSS (last hour)
54_009_HELP=Notifications to TCOSS (last hour)
56_009_NAME=TCSI
56_009_HELP=TCSI
58_009_NAME=TCSI - Memory Locked
58_009_HELP=TCSI - Memory Locked
60_009_NAME=TCSI - Memory Locks/sec
60_009_HELP=TCSI - Memory Locks/sec
```

8.2.4 Language Support and Help Text

KCS supports only English counter names, however if there are any other languages found (additional language sub-keys beside “009” below the registry key “HKLM\SOFTWARE\Microsoft\Windows NT\CurrentVersion\Perflib”) counter names for these will also be written to the counter initialization file with the English text.

Similar there is no additional help text available, but the counter name will also be set as help text.

Accordingly the Windows system registry keys “Counters” and “Help” for the available languages will be updated in “HKLM\SOFTWARE\Microsoft\Windows NT\CurrentVersion\Perflib”.

Example for the counter “Messages from TCOSS (total)” in the counter in file on a German system (“007” is the language code for German, “009” the code for English):

```
8_007_NAME=Messages from TCOSS (total)
8_007_HELP=Messages from TCOSS (total)
8_009_NAME=Messages from TCOSS (total)
8_009_HELP=Messages from TCOSS (total)
```

8.2.5 Registry

The application name for the KCS performance counters is “TcLib”, the configuration can be found here:

```
HKLM\SYSTEM\CurrentControlSet\Services\TcLib\Performance
```

There the KCS library puts the necessary configuration to be called by performance collecting applications. Additionally also the Windows system puts some information here.

The following registry values are written for the Windows system to collect performance data: HKLM\SYSTEM\CurrentControlSet\Services\TcLib\Performance

Registry Key	Type	Default	Description
Library	STRING	“C:\TOPCALL\SHARED\TCLIB32.dll”	Path to the KCS library
Open	STRING	“tcPerfOpen”	The function names of the callbacks of the KCS library that are called by the Windows system to collect performance data to provide them for performance collecting applications like Perfmon.
Collect	STRING	“tcPerfCollect”	
Close	STRING	“tcPerfClose”	

Some of the Windows system keys: HKLM\SYSTEM\CurrentControlSet\Services\TcLib\Performance

Registry Key	Type	Default	Description
Disable Performance Counters	DWORD	0 (not present)	This value will be created and set to 1 by the Windows system if any problems occur when calling the collect functions. When set to 1 the collect functions are not called any longer. This is in order not to disturb any other performance counters.
First Counter	DWORD	-	Indices of the first and last counter names (and help texts) of the KCS performance counters in the “Counters” and “Help” values of the system
First Help	DWORD	-	
Last Counter	DWORD	-	

Last Help	DWORD	-	located here: “HKLM\SOFTWARE\Microsoft\Windows NT\CurrentVersion\Perflib\<lng>” The “First Counter” value is the offset to calculate the absolute counter index from the relative counter index in the counter ini-file.
PerfIniFile	STRING	“TcLibPerf.ini”	Name of the counter initialization file

The following registry values are used internally:
HKLM\SYSTEM\CurrentControlSet\Services\TcLib\Performance

Registry Key	Type	Default	Description
GlobalBufferSize	DWORD	0x20 (not present)	Size of shared memory in kilobytes used for the shared memory structure that consists of the performance data structures. This is sufficient for up to 7 TCOSS instances with enabled performance counters. For bigger systems see section ASP Systems.
PerfTimeout	DWORD	10000	All performance counter functions wait for exclusive access (both the functions for the KCS applications gathering the performance data and the system callback functions providing the data). After the here defined timeout in milliseconds the functions return without having done anything, reporting the error to the event log.
PerfTraceLevel	DWORD	0	For debugging this key can be set to 0xffff. The trace is written to the trace file of the KCS application or to “TCLIBPERF.trc” for performance collecting applications.

The former application name TCSRV and its configuration (HKLM\SYSTEM\CurrentControlSet\Services\TCSRV\Performance) is not used any longer **for performance counters** and is disabled by the new implementation.

Note: The registry sub-key TCSRV is still used as configuration for the **service** that controls all KCS applications.

8.2.6 ASP Systems

The default settings of the KCS performance counters are ok for up to seven TCOSS instances using performance counters. For more instances you have to create the following registry setting:

HKLM\SYSTEM\CurrentControlSet\Services\TcLib\Performance

Registry Key	Type	Value	Description
GlobalBufferSize	DWORD	0x40	Setting for up to 14 TCOSS instances
GlobalBufferSize	DWORD	0x60	Setting for up to 20 TCOSS instances

After configuring this, the shared memory has to be newly initialized. In order to achieve this, all tclib32.dll instances have to be unloaded.

Either you simply reboot the machine, or you have to

1) Stop all performance gathering applications like Perfmon, also remote instances. If TC/SNMP is installed, stop also the SNMP service.

2) Stop all KCS applications by stopping TCSRV and also close TC/Mon; -> after that tclib32.dll should not be loaded any more by any application. You can check that e.g. with the tool “Process Explorer”. Local Perfmon instances are shown as process “mmc.exe”, remote connections use (on Windows 2003) the process “svchost.exe”.

8.2.7 Troubleshooting

In case of problems with the KCS performance counters (if the performance counters are not shown in the Performance Monitor or seem to show wrong values) you can do the following:

1) Check the event-log. Errors are reported there.
2) Check the configuration of the KCS applications. Performance monitoring has to be enabled by the following configuration:

```
HKLM\Software\TOPCALL\<appname>\EnablePerformanceCounters = 1
```

3) Check the configuration of the KCS performance counters. In case of problems the Windows system may disable them by setting:

```
“HKLM\SYSTEM\CurrentControlSet\Services\TcLib\Performance\Disable Performance
Counters” = 1
```

Set it to 0 to enable them again; after restarting (see below) check if the problem persists and if the configuration is changed again.

4) Check the counter initialization file – on Windows Server 2008: C:\ProgramData\TOPCALL\TcLib\TcLibPerf.ini – you may backup and delete it from the original position so that it is newly initialized when the KCS applications are restarted.
5) Stop all performance gathering applications like Perfmon, also remote instances. If TC/SNMP is installed, stop also the SNMP service.
6) Stop all KCS applications by stopping TCSRV and also close TC/Mon; -> after that tclib32.dll should not be loaded any more by any application. You can check that e.g. with the tool “Process Explorer”. Local Perfmon instances are shown as process “mmc.exe”, remote connections use (on Windows 2003) the process “svchost.exe”.
7) Alternatively you can also simply reboot the machine
8) Start again the KCS applications, wait until they are up and running
9) Start Perfmon again and check if the counters are available now
10) In rare cases it can happen that all or part of the performance counters are corrupted so that it is difficult to recover them again - see Microsoft Knowledgebase Article: KB300956 (http://support.microsoft.com/kb/300956/en-us)

If the problem persists:

11) Configure the KCS performance counter trace:

```
HKLM\SYSTEM\CurrentControlSet\Services\TcLib\Performance\PerfTraceLevel = 0xffff
```

12) Stop and restart all applications as described above

Provide the following information:

13) Do other performance counters work correctly?
14) Event-log
15) Version and date of tclib32.dll in c:\topcall\shared

16) Counter initialization file
17) Trace files - location c:\tcoss\trace; from all KCS applications and from Perfmon (“TCLIBPERFx.trc”)
18) Registry export from:

```
HKLM\SYSTEM\CurrentControlSet\Services\TcLib\Performance
HKLM\SOFTWARE\Microsoft\Windows NT\CurrentVersion\Perflib
HKLM\SOFTWARE\TOPCALL
```

8.3 Windows Error Reporting

Some KCS link and server components are server applications that function without user interaction. Even when an application terminates unexpectedly, it must restart without any user interaction. On the other hand, there should be as much information as possible for a subsequent investigation of the problem.

Therefore, Kofax Communication Server setup modifies the standard Windows error handling configuration in the following way:

Behavior for abnormal termination of the operating system:

Registry value	Description	Operating system
HKLM\System\CurrentControlSet\Control\CrashControl\AutoReboot = 1	Automatic reboot without user interaction	All
HKLM\System\CurrentControlSet\Control\CrashControl\CrashDumpEnabled = 1	Write crash dump	All
HKLM\System\CurrentControlSet\Control\CrashControl\LogEvent = 1	Write event log entry	All
HKLM\System\CurrentControlSet\Control\CrashControl\Overwrite = 1	Overwrite crash dump file	All

Behavior for abnormal termination of a process:

Registry value	Description	Operating system
HKLM\Software\Microsoft\Windows\Windows Error Reporting\DontShowUI =1	Disable visual notifications	Windows 2008
HKLM\System\CurrentControlSet\Control\Windows\ErrorMode = 0	Disable visual notifications	All
HKLM\Software\Microsoft\DrWatson\VisualNotification = 0	Disable DrWatson dialog window	All

9. Security Strategy

No doubt there are no secure servers on the market but the level of security or defense measurement depend on the person who looks after the network environment. This chapter is not a security handbook. Neither is it a guarantee for a secure KCS server but it should help you to estimate the scale of raid for your system.

9.1 General

By carelessness, wires often get plugged off or equipment gets switched off. (E.g. cleaning personal) You should allow only authorized personal to have access to the KCS server.

Prepare for failures, virus attacks and security before a violation happens.

9.2 Virus Protection

To check a server, sufficient virus protection software should be at least running daily with actual signature files. The quality of the antivirus software depends on the validity of the signature files (update once a week) so the software will be worthless if the signature is old. One software suit is good but to increase the safety level make periodical checks with different antivirus software.

9.3 Network

Nowadays most computer networks stand behind firewalls and even particular servers within firewall-secured network may have local firewall system activated (like W2k8 servers).
In order to successfully install and deploy software applications within such an environment, system administrators often require detailed information on which TCP and UDP ports are being used for incoming and outgoing communication for particular application or use case.

From the system administrator's point of view, most important information is:

- which side originates the TCP or UDP communication, and which side is the listener (and it does not really matter whether the communication through such a communication channel is bidirectional or unidirectional afterwards)
- which destination port is being used for the communication, in other words, which port must be open on the firewall
- Whether particular connectivity is IPv6 enabled and if so, since which KCS version

Most of the KCS applications/modules use only one or at least only a few fixed separate ports (for example the TCOSS – LS1 communication uses only port number 5000) for their intra-communication matters, and it is quite easily configurable on every firewall system.

On the other hand, there are many KCS applications/modules communicating with or through third-party products (e.g. mail clients) where the TCP/UDP connectivity is not so straightforward (for example TC/Report – MS SQL server, or H.323 FoIP/VoIP integration), where one well-known TCP or UDP port is being used to establish the first connection through which further dynamic higher TCP or UDP ports to be used are agreed. Such a communication setup is a challenge for every system administrator and his firewall.

Following tables provides a summary which ports are being used with KCS products:

- In the case of third-party connection, often a URL link is provided to appropriate the third-party product's documentation as how to configure particular product to work across firewalls.
- If the column Dest. Port does not contain a single port but a dynamic port range instead, it is recommended to refer to the corresponding product's manual for details and/or third-party documentation if the Url available in the column Purpose
- Column "IPv6 enabled" contains the information since which KCS version particular connectivity is IPv6 enabled on Windows 2008, Windows 7 and later versions of Windows operating systems. Note that "N" stands for not supported

Note: Column "Conf" declares whether the port or port range is configurable (Y) or not (N)

Basic Intra-KCS Component Connections

Originator (Caller)	Listener (Callee)	Dest. Port	IPv6 enabled	Conf	Purpose
Any KCS Client(1)	TCOSS (single instance)	64508/tcp	KCS 9.0(3)	Y	TCTI RPC connection from any client to the TCOSS server
Any KCS Client(1)	TCOSS01-TCOSS20	64510/tcp 64512/tcp … 64548/tcp	KCS 9.0(3)	Y	TCTI RPC connection from any client to the TCOSS01-20 (multi-TCOSS operation)
Any KCS Client(1)	TC/Archive (single instance)	64509/tcp	KCS 9.0(3)	Y	TCTI RPC connection from any client to the TC/Archive server
Any KCS Client(1)	TC/Archive01-TC/Archive20	64511/tcp 64513/tcp … 64549/tcp	KCS 9.0(3)	Y	TCTI RPC connection from any client to the TC/Archive01-20 server (multi- TC/Archive operation)
Secondary TCOSS	Primary TCOSS	64256/tcp	KCS 9.0	Y	Secondary TCOSS to Primary TCOSS data link
Secondary TCOSS01-20	Primary TCOSS01-20	64261/tcp 64266/tcp … 64356/tcp	KCS 9.0	Y	Secondary TCOSS01-20 to Primary TCOSS01-20 data link (multi-TCOSS operation)
Primary TCOSS	Status Agent	64257/tcp 64258/tcp	KCS 9.0	Y	Primary TCOSS to Status Agent connection 1 and 2
Primary TCOSS01-20	Status Agent	64262/tcp 64263/tcp 64267/tcp 64268/tcp … 64357/tcp 64358/tcp	KCS 9.0	Y	Primary TCOSS01-20 to Status Agent connection 1 and 2 (multi-TCOSS operation)
Primary TCOSS (all instances)	TCSRV	64386/tcp	KCS 9.0	N	Restart of secondary master using TCSRV (option "/TCP1" on primary master).
Secondary TCOSS	Status Agent	64259/tcp 64260/tcp	KCS 9.0	Y	Secondary TCOSS to Status Agent connection 1 and 2
Secondary TCOSS01-20	Status Agent	64264/tcp 64265/tcp 64269/tcp 64270/tcp … 64359/tcp 64360/tcp	KCS 9.0	Y	Secondary TCOSS01-20 to Status Agent connection 1 and 2 (multi-TCOSS operation)
Storage	Media Server	64505/tcp	KCS 9.0	Y	TCOSS Storage Server connection to the

Server					Media Server (ASP operation)
TCOSS	LS1	5000/tcp	KCS 9.0(2)	Y	TCOSS connection to the LS1
TCECP	LS1	5001/tcp 5002/tcp	KCS 9.0(2)	Y	TCECP (Voice Server) connection with LS1
TCPMeter	LS1	5011/tcp	N	Y	TCPMeter connection with the LS1
TC/LINK-WM	GSM/SMS Box	5004/tcp	N	N	Connection to GMS/SMS box
TC/LINK-WM	SMS Box	30704/tcp	KCS 10.2	N	SMS Box reset (optional)
TCUAS	TCOSS	445/tcp	N	N	TCUAS console with the TCOSS
TCMON KCS Monitoring API	TCSRV	445/tcp	KCS 9.0	N	TCMON connection with the TCSRV service
TCMON KCS Monitoring API	TCSRV	64385/tcp	KCS 9.0	N	TCMON or WMI Provider for applications, using standard TCP port for connection to the TCSRV service
KCS Monitoring API	TCSRV	64384/tcp	KCS 9.0	N	WMI Provider for applications, using dedicated port for connection to the TCSRV service

(1) All TC/LINKs, TCfW, TC/Web, TWS, …

(2) TCOSS-LS1 and TCECP-LS1 IPv6 connection supported through NAT-PT translation

(3) IPv6 enabled via TCTI RPC only (no IPv6 support for TCTI native)

Note that some intra KCS connections are using ports within the default dynamic port range (49152 – 65535) for Windows 2008 or higher. This range is reduced by KCS setup to 49152 – 61439 in order to avoid possible port conflicts. (See bug 687664 for more technical details)

KCS server connections to third-party components

Originator (Caller)	Listener (Callee)	Dest. Port	IPv6 enabled	Conf	Purpose
H.323 with FoIP/VoIP Component	IPPBX or gateway	1720/tcp	N	Y	H.323/H.225 call signaling
IPPBX or gateway	H.323 FoIP/VoIP Component		N	N/A	
H.323 with FoIP/VoIP Component	IPPBX or gateway	1024-65535/tcp	N	N	H.323/H.245 call setup (particular port from this range agreed during H.225 signaling exchange and the calling H.323 endpoint establishes connection to this port)
IPPBX or gateway	H.323 with FoIP/VoIP Component		N	N/A	
H.323 with FoIP/VoIP Component	IPPhone or Gateway	10000-10999/udp	N	Y	Voice media data, particular port number from this range is agreed through H.245 call control
IPPhone or Gateway	H.323 with FoIP/VoIP Component		N	N/A	
SIP with FoIP/VoIP Component	IPPBX or gateway	5060/udp	KCS 9.0 (FoIPv3 only)	Y	SIP call signaling
IPPBX or gateway	SIP with FoIP/VoIP Component		KCS 9.0 (FoIPv3 only)	N/A	
SIP with FoIP/VoIP Component	IPPhone or Gateway	10000-10999/udp	KCS 9.0 (FoIPv3 only)	Y	Voice media data
IPPhone or Gateway	SIP with FoIP/VoIP Component		KCS 9.0 (FoIPv3 only)	N/A	
Internet Browser	TC/Web/ IIS Server	80/tcp or 443/tcp	KCS 9.0	Y	Client Internet browser connection with TC/Web
TC/Report TC/Probe KCS Monitoring API	MS-SQL	1434/udp 1433/tcp Random high TCP ports	N	Y	Through UDP connection to the SQL Server browser service the current port number of the particular named-SQL server instance is being fetched (the default SQL server instance listens on the 1433/tcp) See also

					http://msdn.microsoft.com/en-us/library/cc646023.aspx
TC/SPI-MX	Exchange server 2003/2007	135/tcp Random high TCP ports	N	Y	At first a connection to MS-RPC endpoint mapper is established (port 135), which tells to the client which ports to use to connect to particular Exchange service (typically high TCP ports like 57000,…) See also http://support.microsoft.com/kb/270836/en-us
TC/SPI-LN	Notes Server	1352/tcp	N	Y	Through installed Notes client
TC/Player TC/Dialer (through TCE_REM, the “remote engine”)	TCECP (Voice Server)	135/tcp Random high TCP ports	N	Y	At first a connection to MS-RPC endpoint mapper is established (port 135), which tells the client which ports to use for connecting to particular RPC service (random TCP ports ranging from 1024 to 5000) for details see Voice Platform Manual See also http://support.microsoft.com/kb/154596/en-us
TC/Report (workstation fetch) KCS Monitoring API	WMI	Random high TCP ports	KCS 9.0	Y	WMI runs as part of a shared service host with ports assigned through DCOM by default. Starting with Windows Vista, you can also specify a fixed port. See also http://msdn.microsoft.com/en-us/library/bb219447%28VS.85%29.aspx

Connections of KCS links to third-party components

Originator (Caller)	Listener (Callee)	Dest. Port	IPv6 enabled	Conf	Purpose
TC/LINK-SM	SMTP Server	25/tcp	KCS 9.0	Y	Standard SMTP protocol
SMTP Server	TC/LINK-SM		KCS 9.0	N/A	
TC/LINK-SC7	SMTP Server	25/tcp	KCS 9.0	Y	Standard SMTP protocol
SMTP Server	TC/LINK-SC7		KCS 9.0	N/A	
TC/LINK-MX7	Exchange 2007	25/tcp	KCS 9.0	Y	Standard SMTP protocol
Exchange 2007	TC/LINK-MX7		KCS 9.0	N/A	
TC/LINK-MFP	MFP Device	25/tcp	KCS 9.0	Y	Standard SMTP protocol
MFP Device	TC/LINK-MFP		KCS 9.0	N/A	
TC/LINK-MX	Exchange Server 2003 / 2007	135/tcp Random high TCP ports	N	Y	At first a connection to MS-RPC endpoint mapper is established (port 135), which tells to the client which ports to use to connect to particular Exchange service (typically high TCP ports like 57000) See also http://support.microsoft.com/kb/270836/en-us
TC/Soap	Web Server	80/tcp 443/tcp	N	Y	Standard http and https ports
WebService client	TC/Soap		N		
TC/LINK-SC	SAP Router	3299/tcp	N		
TC/LINK-MQ			N	Y	
TC/LINK-WM	GSMBox Mod350	5004/tcp	N	Y	GSMBox
TC/LINK-MD	SMS Centre	Xxx/tcp	N	Y	Used port numbers depends on the SMS provider
SMS Center	TC/LINK-MD	Xxx/tcp	N	Y	
TC/LINK-LN	Notes Server	1352/tcp	N	Y	Through installed Notes client

Further interesting reading (Network Ports Used by Key Microsoft Server products):

http://www.microsoft.com/smallbusiness/support/articles/ref_net_ports_ms_prod.mspx

9.4 Password

Default passwords are often easily cracked. So in your own interest do not use common names as password. E.g. the name of you company, month, weekday or personal names. Most password hacking software use word databases for the attack. Even common word and number combination are included. E.g. “john15”, “eva55”, “KCS1” etc.

Also the storage of the password is significant so it is understandable that any password written on the back of the keyboard is not more secure than a blank one.

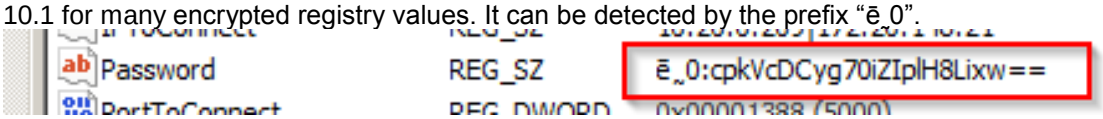
Recommended: use alphanumeric combinations, upper and lower cases and special characters. So the risk of just guessing the password is low.

E.g. “NoA4ymF” what has the meaning of “No Access four you my Friend”

9.5 Registry Encryption

Some private information (like passwords) are saved as encrypted values in the registry using one of the following encryption methods:

- Kofax-Standard: This a Kofax proprietary standard encryption that is presented as hex or base-64 characters.
- AES: This is a more secure encryption based on AES-256 (FIPS 197). It is supported since KCS 10.1 for many encrypted registry values. It can be detected by the prefix “ē˜0”.



The registry value HKLM\Software[\Wow6432Node]\TOPCALL\Common\RegistryEncryption can be used to control the encryption standard as described below:

Value	Description
10	Encrypt all new values with Kofax-Standard. KCS still works with existing AES encrypted values, but these values are not re-encrypted to Kofax-Standard. This mode is fully compatible with KCS 10.0.1 or older.
20	Encrypt all new values with AES but do not change existing encrypted values.
40	Encrypt all new values with AES and re-encrypt some existing values with Kofax-Standard with AES.

Notes and restrictions:

- AES encrypted values are not supported by KCS 10.0.1 (or older). Restrictions of KCS 10.1 and 10.1.1 can be found in the platform manual for these releases.
- It may also be required to use Kofax-Standard encryption with professional-services modules.
- AES encryption is never used for values entered during KCS Setup. It is also not supported by Easy Config.
- AES encryption is not supported for registry value TCROUTE\ServerX\Password, which is used by TC/Broadcast modules TCRESMF and TC/WEB-MF.

- Automatic re-encryption (with RegistryEncryption value 40) of Kofax-Standard to AES encryption is supported by many but not for all values. If automatic re-encryption is not support, the clear-text password must be entered into the registry (as with RegistryEncryption value 20) if AES encryption is required.
- KCS setup creates the value RegistryEncryption with mode 20, if it does not exist. This usually happens with new installations or updates from KCS 10.0.1 (or older).

9.6 Services

Many services are installed on each Windows computer by default. The following list displays a summary of the services and network protocols needed/supported from KCS software.

Service or Device name	**Recommended start up option**	**required for**
net logon	Auto	for authentication on a domain controller
workstation	Auto	required for network access to shared files/printers and break messages. This service is very important for TCLANPRT and TCFILBRK
Event log	Auto	store all error messages. THIS SERVICE IS MANDATORY.
messenger	Auto	required for reception of LAN break messages
RPC Service	Auto	required for TCTI transport RPC. It is recommended to use RPC instead of native transport wherever this is possible.
Server	Auto / Manual	only required if files or printers should be shared on the network. Note: If this service is not running, the Computer will not be visible in the Computer Browser list (e.g. Network Neighborhood), but administrative shares (e.g. C$ for drive C) are still usable.
TCP/IP NETBIOS helper	Auto	Required when using windows networking via TCP/IP.
Spooler service	Auto	required for printing
Alerter	Auto	this service allows sending alerts if a critical system state has been detected (e.g. disk drive almost out of space). It is not mandatory but recommended for KCS servers.
SAP agent	Auto	Required if TCTI via IPX/SPX (RPC) is used on a KCS or TC/ARCHIVE server. Can be installed via *Control panel – Network – services – Add – select "SAP Agent"*.
TCSRV	Auto	Required for automatic start-up of KCS application after e.g. power failure and for supervising processes via TCMON.
Net bios interface	Manual	Required when using TCTI (native or RPC) with Net bios interface
WINS Client (TCP/IP)	Auto	required for TCP/IP

Below you can see an overview of all Services and Drivers (except LAN card driver) required by TCTI:

Protocol	native transport	RPC transport
TCP/IP	WINS Client (TCP/IP)	RPC Service, WINS Client (TCP/IP)
NETBIOS	NetBIOS Interface, NETBEUI	RPC Service, NetBIOS Interface, NETBEUI
IPX/SPX	not supported	RPC Service, SAP agent, NWLink IPX/SPX comp. Transport

9.7 Remarks

For any further information please refer to the manual from the particular software.

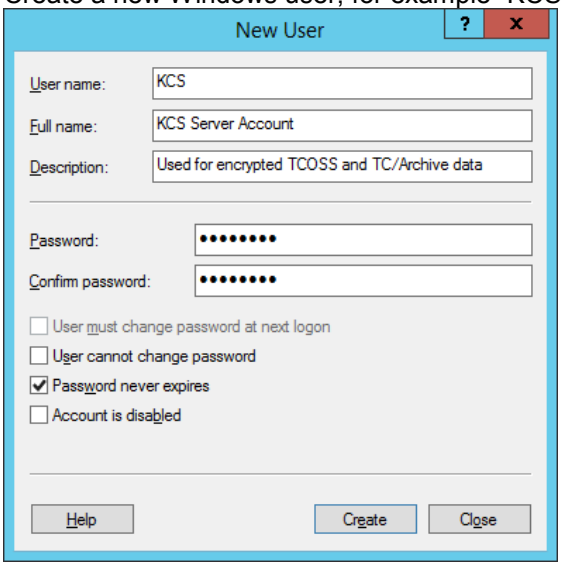
10. Encrypting File System and KCS

Encrypting File System (EFS) is a Windows feature that can be used to encrypt specific files, folders, or drives. It protects confidential data from attackers with physical access to the computer.

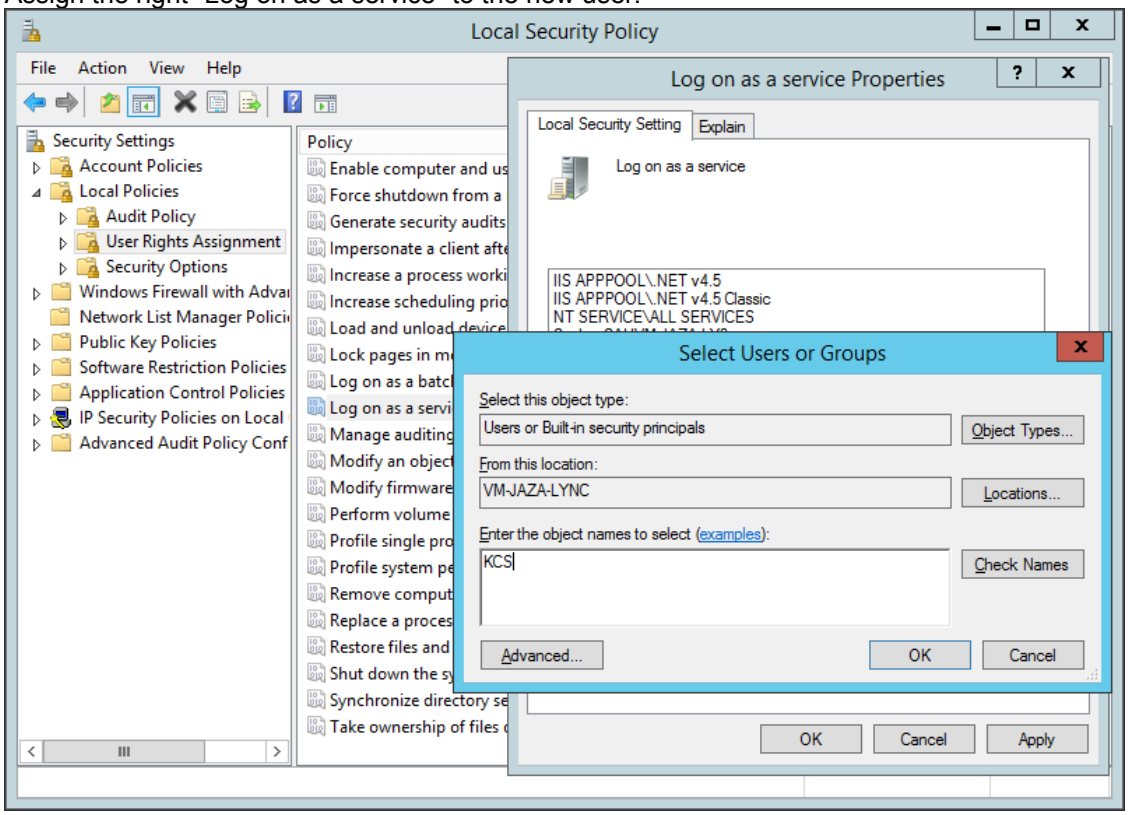
EFS can be used to encrypt the data files of KCS core (TCOSS) and TC/Archive.

10.1 Encrypting TCOSS

1) Create a new Windows user, for example “KCS”.

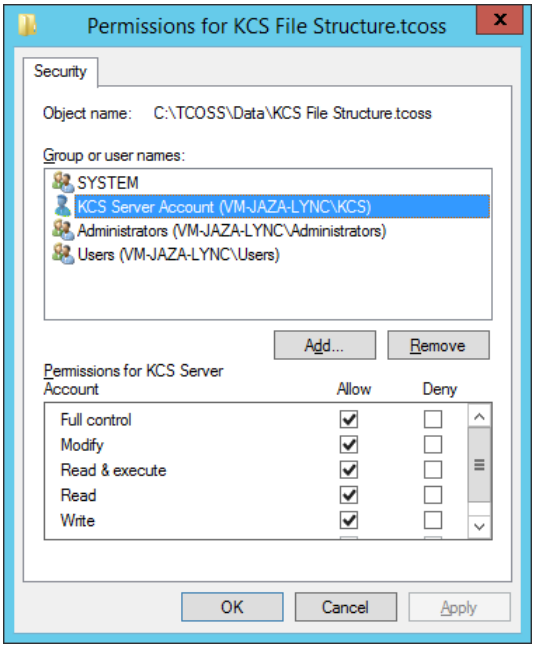


2) Assign the right “Log on as a service” to the new user.

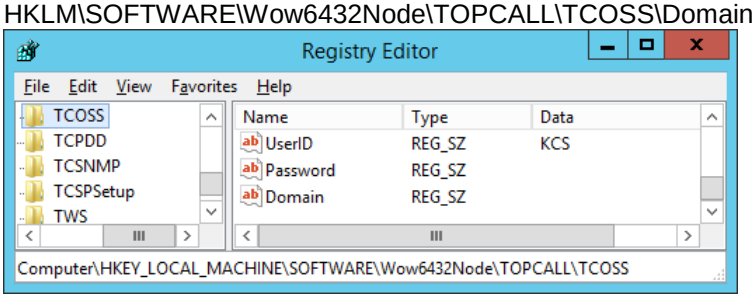


Note: Consider the following bug http://support.microsoft.com/kb/2411938/en-us

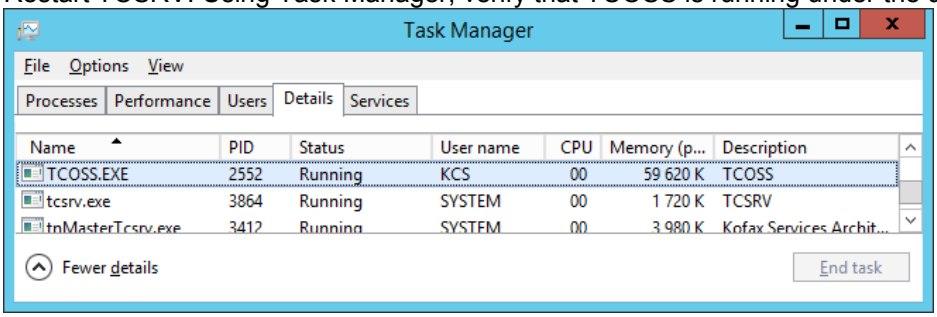
3) Grant the user full control permissions for the TCOSS file structure file, by default C:\TCOSS\Data\KCS File Structure.tcoss.



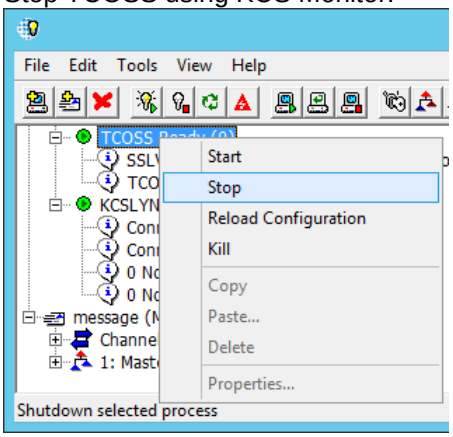
4) Configure TCOSS to run as user “KCS” – create or edit the Windows registry values HKLM\SOFTWARE\Wow6432Node\TOPCALL\TCOSS\Domain, UserID, and Password appropriately.



5) Restart TCSRV. Using Task Manager, verify that TCOSS is running under the user “KCS”.

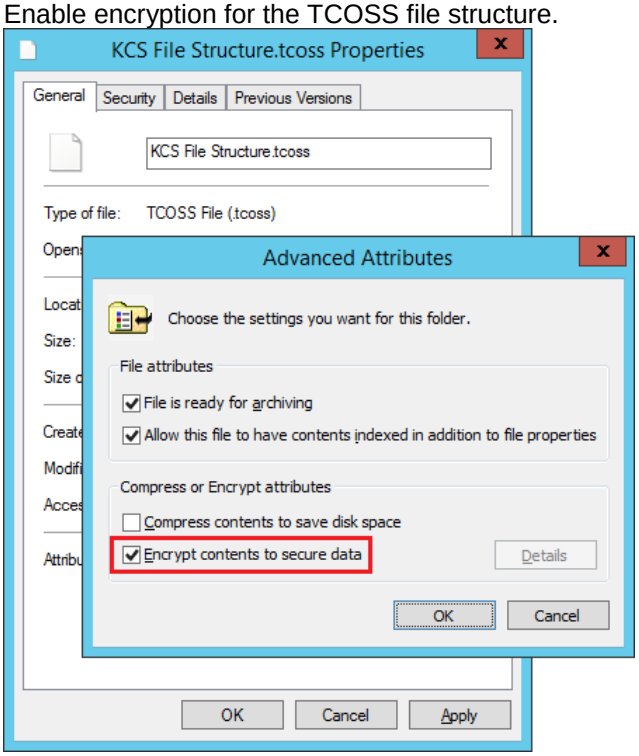


6) Stop TCOSS using KCS Monitor.



7) Log on to Windows as the user “KCS”.

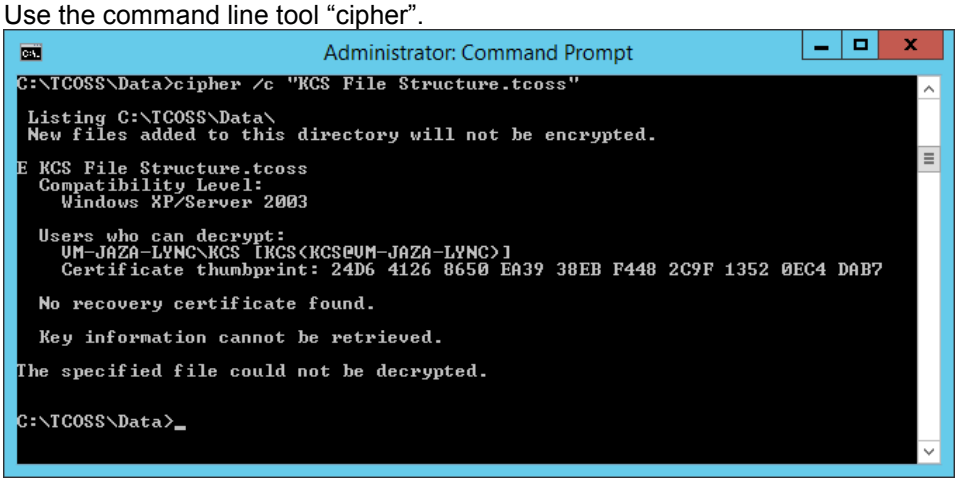
8) Enable encryption for the TCOSS file structure.



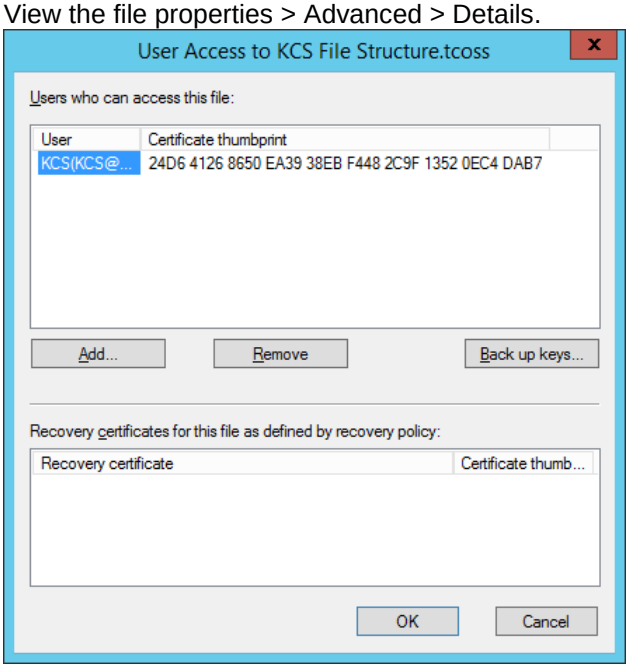
9) Log off as “KCS”. Log back on as administrator and start TCSRV.

You can verify the encryption state with either of the following methods:

- Use the command line tool “cipher”.

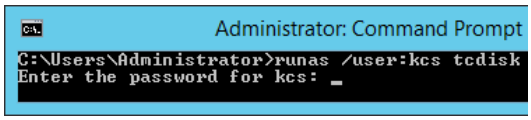


- View the file properties > Advanced > Details.



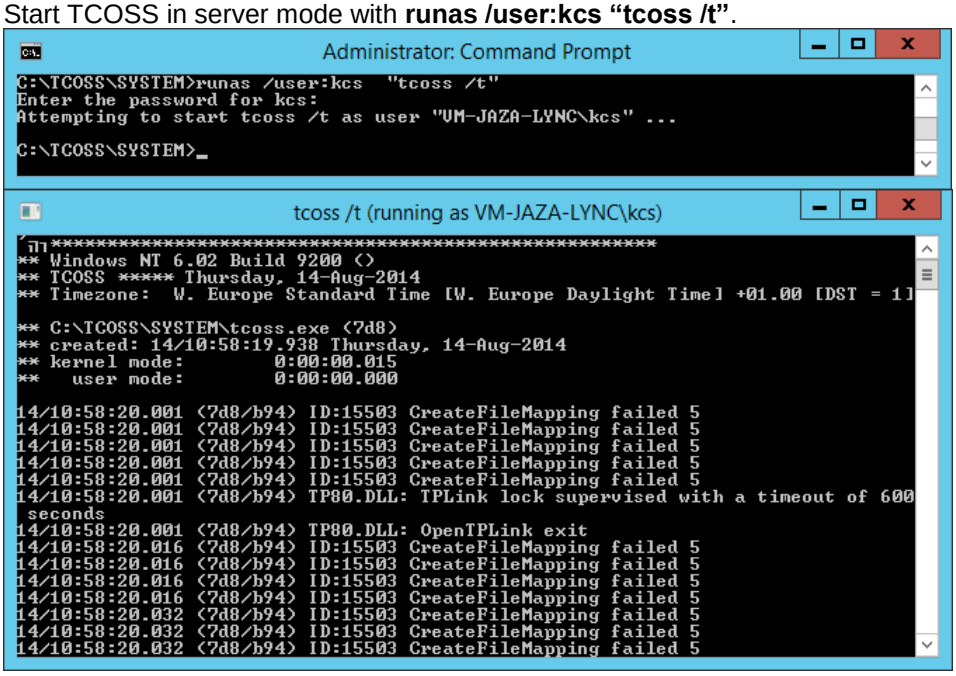
10.2 Maintenance of Encrypted TCOSS

TCDISK must be started with **runas /user:kcs tcdisk**.



WCONFIG can be used without restriction, as long as Get / Install Locally is not required. To use Get / Install Locally, follow these steps:

- Stop TCOSS using KCS Monitor.
- Start TCOSS in server mode with **runas /user:kcs “tcoss /t”**.



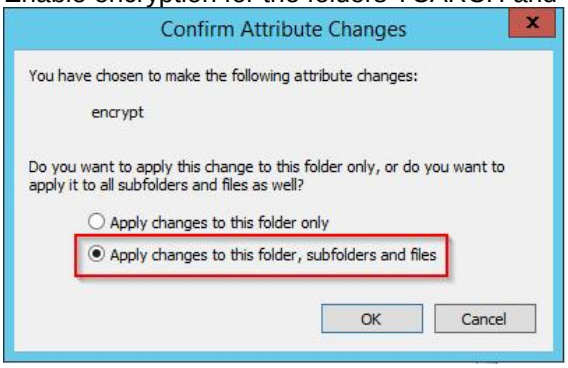
- Start WCONFIG. You can now Get / Install Locally (but not via net).
- When you are done, stop the special TCOSS mode by pressing Ctrl+C.
- Start TCOSS normally using KCS Monitor.

You can use other low-level TCOSS tools (for example tcdir, tccopy, tcdel) in the same way (tcoss /t).

10.3 Encrypting TC/Archive

This procedure is very similar to section *Encrypting TCOSS.*

1) Create a new Windows user, for example “KCS”.
2) Grant the user full control permissions for the TC/Archive folders TCARCH and CDTemp.
3) Configure TC/Archive to run as user “KCS” – create or edit the Windows registry values HKLM\SOFTWARE\Wow6432Node\TOPCALL\TCARCH\Domain, UserID, and Password appropriately.
4) Restart TCSRV. Using Task Manager, verify that TCARCH.exe is running under the user “KCS”.
5) Stop TC/Archive using KCS Monitor.
6) Log on to Windows as the user “KCS”.
7) Enable encryption for the folders TCARCH and CDTemp. Apply the encryption to subfolders as well.



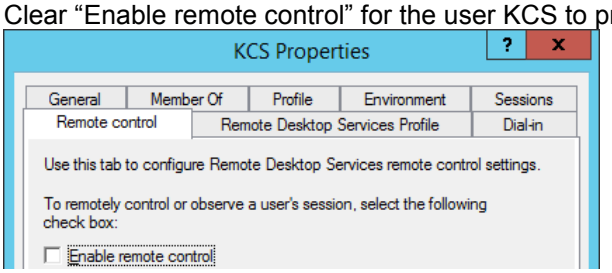
8) Log off as “KCS”. Log back on as administrator and start TCSRV.

Now all online volumes are encrypted. Data in the offline volumes are encrypted differently, see TC/Archive Manual for more information.

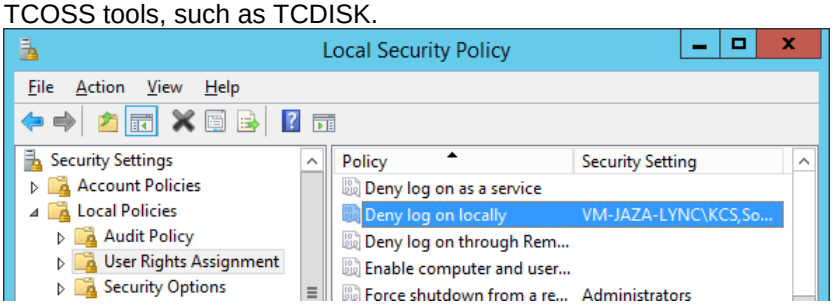
10.4 Restricting User Rights

Optionally, you can restrict the rights of the user “KCS” for additional security.

- Clear “Enable remote control” for the user KCS to prevent remote connections for this user.

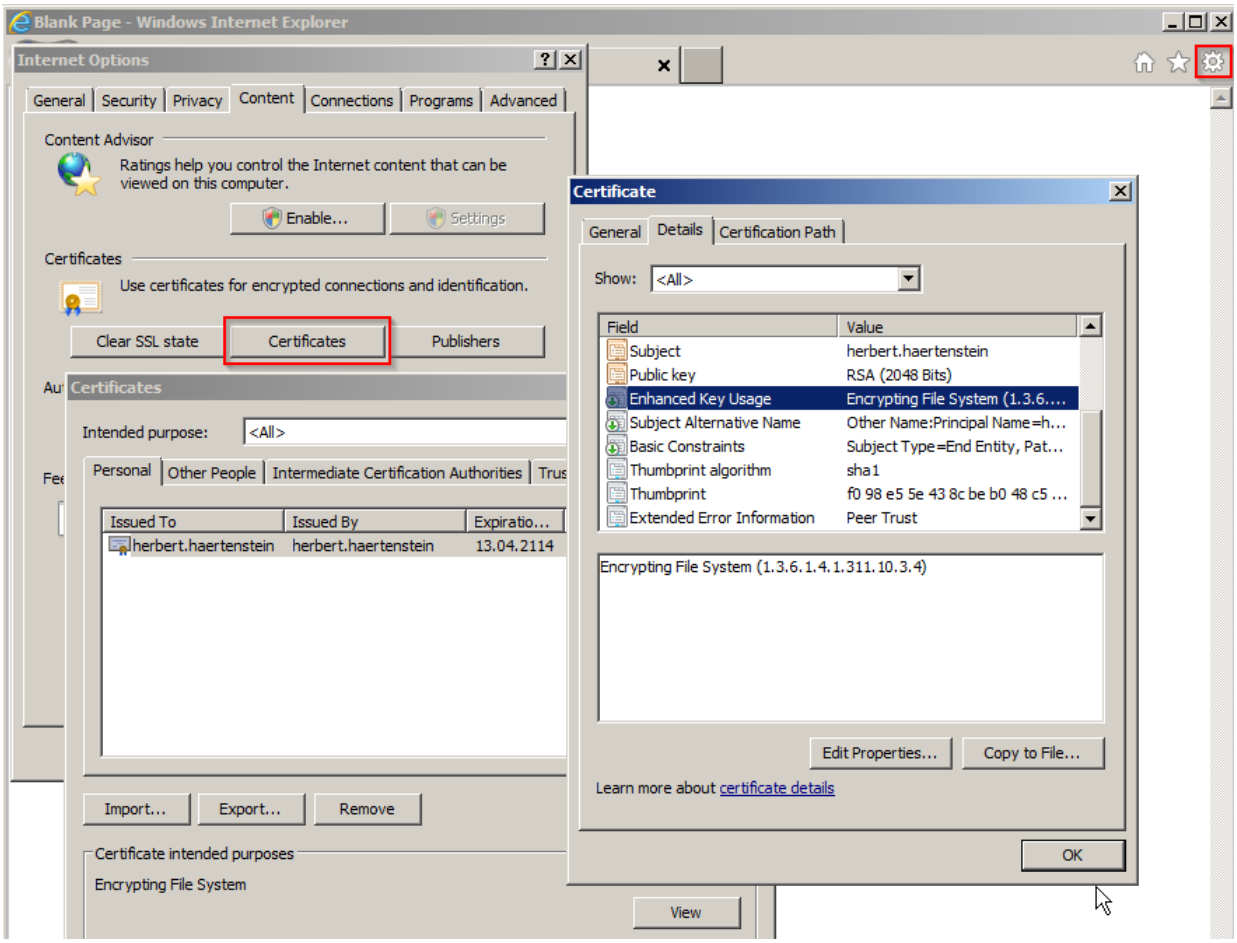


- “Deny log on locally” for the user KCS. After this change, it is no longer possible to log on to the computer as user KCS, or run any process interactively as this user. This also prevents the usage of TCOSS tools, such as TCDISK.



10.5 EFS Information

EFS encrypts data with a random file encryption key (FEK). The FEK is stored encrypted with the public EFS key. The related certificate can be viewed in the Certificate store.



The EFS private/public key is stored (protected by Windows password) in user profile.

For more information, see http://technet.microsoft.com/en-us/library/bb457116.aspx.

11. Installation Requirements

11.1 Important Safety Instructions

SAVE THESE INSTRUCTIONS

See APPENDIX A for other languages!

Read and understand all instructions!

Follow all warnings and instructions marked on the product!

Do not use this product near water or in a wet basement!

Do not place that product on an unstable cart, stand, or table. The product may fall, causing serious damage to the product!

Slots and openings in the cabinet and the back or bottom are provided for ventilation, to protect it from overheating, these openings must not be blocked or covered. This product should never be placed near or over a radiator or heat register. This product should not be placed in a built in installation unless proper ventilation is provided.

This product should be operated only from the type of power source indicated on the marking label.

Do not allow anything to rest on the power cord. Do not locate this product where the cord will be abused by persons walking on it.

Do not overload wall outlets and extension cords as this can result in the risk of fire or electric shock.

Never push objects of any kind into this product through cabinet slots as this may touch dangerous voltage points or short out parts that could result in a risk of fire or electric shock. Never spill liquid of any kind on the product.

Device must be opened only by Authorized Service Personnel! High Voltage inside!

Unplug this product from the wall outlet and refer servicing to qualified service personnel under the following conditions:
When the power supply cord or plug is damaged or frayed.
If liquid has been spilled into the product.
If the product has been exposed to rain or water.
If the product does not operate normally by following the operating instructions. Adjust only those controls that are covered by the operating instructions because improper adjustment of other controls may result in damage and will often require extensive work by a qualified technician to restore the product to normal operation.
If the product has been dropped or the cabinet has been damaged.
If the product exhibits a distinct change in performance.

For complete removal of power from device disconnect both power supply cords!

The power supplies shall only be exchanged or serviced if the unit is switched off and both power cords are removed.

The main socket outlet shall be installed near the equipment and shall be easily accessible!

For the power supply cord(s) use a flexible cord with a 1.5-4.5m (5-15 foot) length and ground connection. Rating should be 230V/6A minimum.
An equipment grounding conductor that is not smaller in size than the ungrounded branch circuit supply conductors is to be installed as part of the circuit that supplies the system. Bare, covered, or insulated grounding conductors are acceptable. Individually covered or insulated equipment grounding conductors shall have a continuous outer finish that is either green, or green with one or more yellow stripes.
The attachment-plug receptacles in the vicinity of the system are all to be of a grounding type.

This unit is intended to be installed in Restricted Access Locations only.

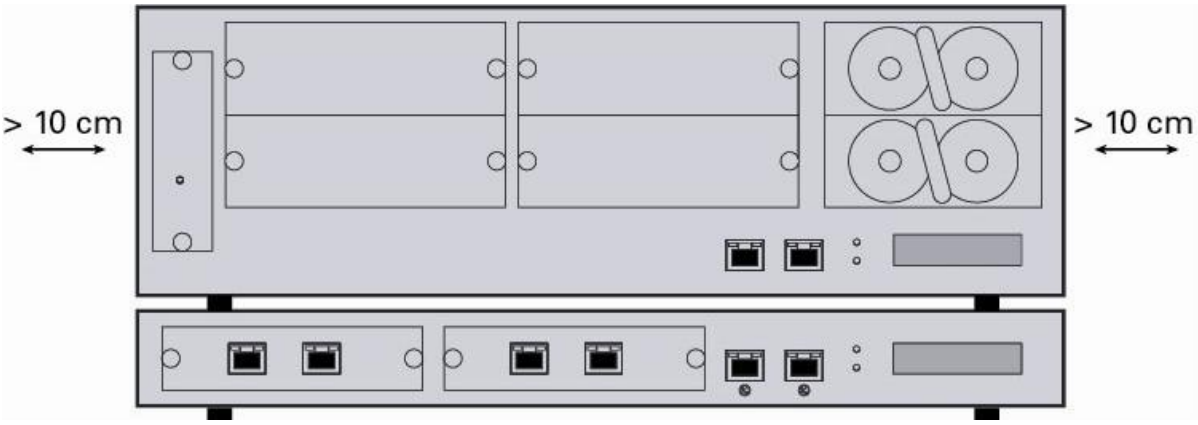
The provided CD-Drive (some models only) is classified as Laser Class I and complies with 21 CFR Subchapter J.

ATTENTION! Danger of explosion if internal Lithium Battery is replaced improperly. Replace only with same type or with replacement type recommended by the manufacturer. Dispose used batteries according to manufacturer’s instructions.

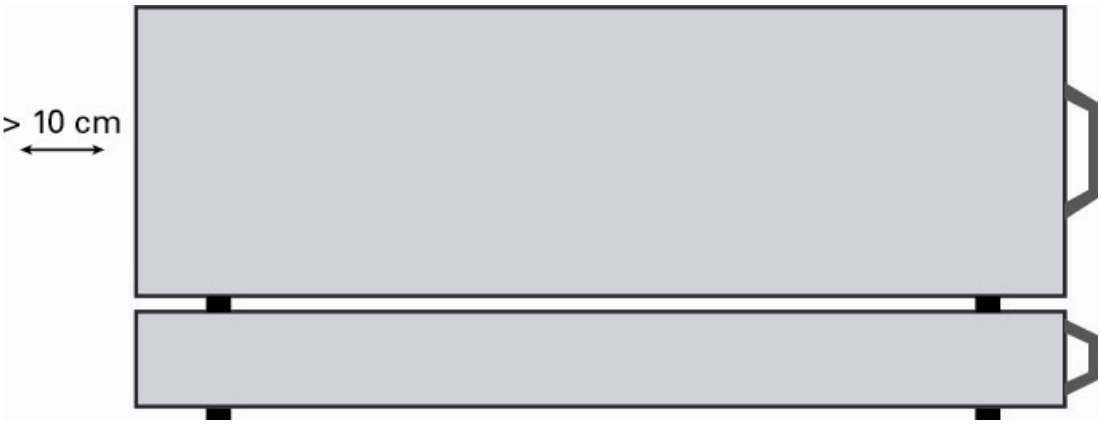
11.2 Desktop Mounting

The KCS cabinet requires a place with easy access, power supply and enough space for ventilation. At the rear must be enough room for cabling. At the left and right must be enough space for ventilation.

Side distance



Rear distance

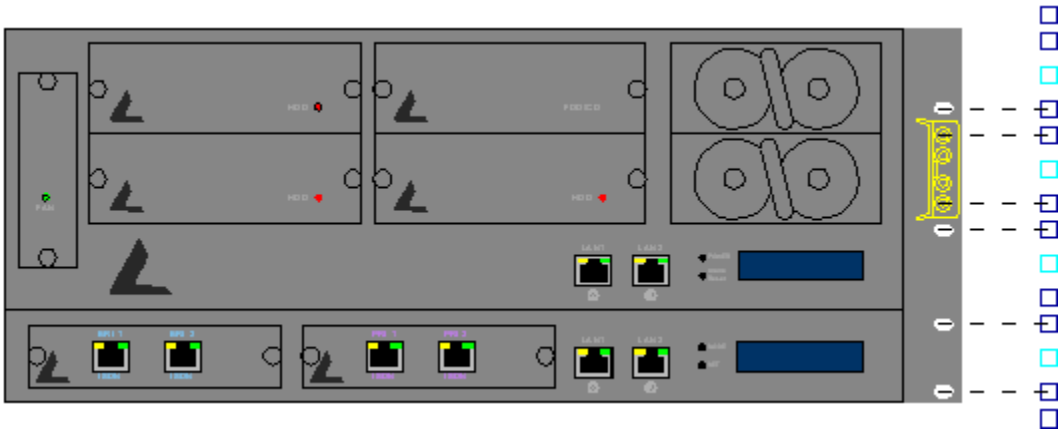


Attention: Leave 1HE of 19” rack free above the RAID cabinet (for cooling purposes)!

11.3 Rack Mounting

The KCS Models 305 may be mounted in any 19” standard rack with cooling and minimum depth of 600mm. One KCS Model 305 requires 1HE (45mm / 1 ¾” height).

Model 305, since it is quite small and light, is not intended to be mounted on sliding rails – simply screw it with the front screws to the vertical rack rails.



Rack Mount Instructions

A) Elevated Operating Ambient – If installed in a closed or multi-unit rack assembly, the operating ambient temperature of the rack environment may be greater than room ambient. Therefore, consideration should be given to installing the equipment in an environment compatible with the maximum ambient temperature (Tma) specified by the manufacturer. Refer to 11.4 *Operating Temperature* for more details.

B) Reduced Air Flow – Installation of the equipment in a rack should be such that the amount of air flow required for safe operation of the equipment is not compromised. Refer to *11.4 Operating Temperature* for more details.

C) Mechanical Loading – Mounting of the equipment in the rack should be such that a hazardous condition is not achieved due to uneven mechanical loading.

D) Circuit Overloading – Consideration should be given to the connection of the equipment to the supply circuit and the effect that overloading of the circuits might have on overcurrent protection and supply wiring. Appropriate consideration of equipment nameplate ratings should be used when addressing this concern. Refer to *11.1 Important Safety Instructions* for details.

E) Reliable Earthing – Reliable earthing of rack-mounted equipment should be maintained. Particular attention should be given to supply connections other than direct connections to the branch circuit (e.g. use of power strips). Refer to *11.1 Important Safety Instructions* for details.

11.4 Operating Temperature

Temperature: Min. +10°C / 50°F
Max. +40°C / 104°F, RAID cabinet max. +32°C / 90°F

The KCS system works on a desktop installation without any additional cooling in a typical office environment. Non desktop installations require proper mounting to provide airflow and prevent overheating. In case of doubt external ventilation should be provided (e.g.: rack-mounted).

11.5 Access Protection

To guarantee 24-hour continuous operation you should place the KCS system at a place where unauthorized access is impossible. The power supply has to be protected from unintentional disconnection.

11.6 Dust Protection

The room where the KCS system is placed should be free of dust and other air pollution (like normal office environment).

11.7 General

It is recommended to use a separate power circuit or an uninterruptible power supply (UPS). Depending on the installation the customer must provide two or more power sockets.

11.8 Cabling

Public Services

In case the connections of your public services (fax, telex ...) are to be moved to another place or have to be installed new this work has to be done by your local PTT authorized partners. Take into consideration that PTT works could take some time.

Note: The connections must be provided in operating condition at the agreed installation date.

Asynchronous Connections

Only shielded cables should be used to ensure proper operation to avoid any electric or magnetic interference.

For the maximum cable length individual EDP specifications are valid. If modems (or in-house modems) are required it is up to the customer or its subcontractor to have them installed and working. The proper operation of the connection must be checked by connecting a terminal.

Note: The connections must be provided in operating condition at the agreed installation date.

Cable Form

The cable has to be in one piece from end to end. It is not allowed to put more pieces together. Cables to ISDN, Analogue or E&M devices must be shielded and have to be equipped with ferrite cores provided by Kofax. The cores must be mounted as near as possible to the KCS Server. The cable has to be wound around the core twice (turns as far apart as possible). Cabling has to be 26 AWG (0,13mm^2) size as a minimum.

Cabling Work

The cabling work cannot be performed by your KCS engineer. Please have this work done by your company electrician. On each end there have to be some meters left for later movements, plug mounting and maintenance.

12. KCS Licensing

12.1 Licensing General

KCS software is protected by license keys. These keys are maintained in the KCS server. At the time of installation the KCS engineer enters all required licenses.

Licenses: A license key is required in order to enable a specified number of instances of a program. All licenses are entered using the KCS Licensing Tool, LICENCES.EXE.

12.2 Licensing Modes

Starting with version 7.46.00, TCOSS supports a new licensing mode. This new licensing mode is equipped with its own set of license keys, the “new mode license keys”. The license keys which are used in the previous old licensing are called “old mode license keys”. In January 2002 Kofax published a new price list. If you order a product from this new price list you get a new mode license key. If you order a product from the old price list you get an old mode license key.

Find information about old mode licensing and upgrade from old to new mode in System manual V3.00.01.

Compatibility of Modes:

TCOSS can run either in the old licensing mode or in the new licensing mode. A “mixed mode” operation is not possible. When running in the old licensing mode TCOSS will only accept old mode license keys. On the other hand if it is running in the new licensing mode TCOSS accepts only new mode license keys.

Registrations:

Each instance of a program registers at the server at login time. This registration information is used to count the number of used instances. Login is possible if a valid license key and a registration are available. Inactive registrations, where no login has been recorded for more than a month, will be deleted automatically by the system. In addition, the system administrator can delete registrations manually at any time using TCfW Communication Server Client.

Different types of registrations are used:

- Per user registrations
- Per instance registrations
- Per workstation registrations
- Per server system registrations

12.3 Client Licensing

The Client licensing provides the TCfW, TC/Web, TFC, and a TC/Player license.

A TFC license allows you to use as many TFC applications as you like in your whole KCS system. In other words it is licensed per system. TFC based applications do not use up channels on TCOSS.

12.4 Link Licensing

12.4.1 Per User Link Licensing

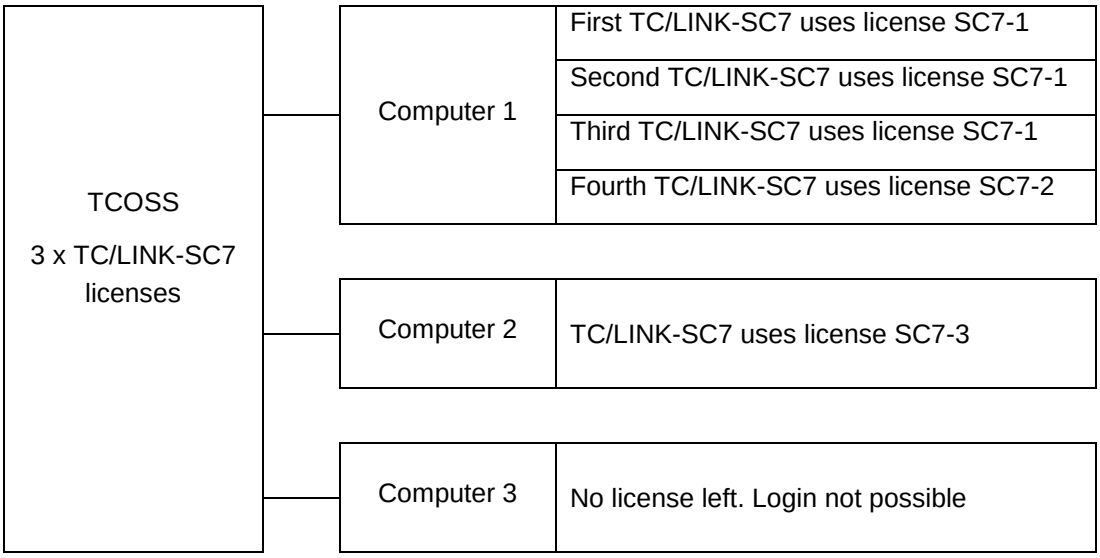
Some TC/Links are licensed per user, such as:

- TC/LINK-LN
- TC/LINK-MX

12.4.2 Business Application Integration Link Licensing

TC/Link-SC, TC/Link-SC7 and TC/Link-AC use a special form of per instance Licensing. First of all you need a license for every workstation on which a TC/Link-SC is running. Then, for every 3 instances of TC/Link-SC which are running on the same workstation, you need one TC/Link-SC license. Exactly the same licensing rules apply to TC/Link-SC7.

In the following example you see one TCOSS with 3 TC/Link-SC7 licenses. On PC1 we have 4 instances of TC/Link-SC7 installed, on PC2 and PC3 one instance of this link is installed. The 4 TC/Link-SC instances on PC1 consume 2 licenses because every 3 instances on a workstation consume 1 license. The TC/Link-SC7 on PC2 uses the third license. Therefore there is no license left for the TC/Link-SC7 on PC3 to log in to the TCOSS server.



12.4.3 Other Link Licenses

All other TC/Links (e.g. TC/Link-FI, TC/Link-MD…) are licensed per workstation. For every workstation hosting one or more instances of a certain TC/Link you need one license of that TC/Link. And it does not affect this rule if a TC/Link is installed on a KCS Link server or on any other hardware.

12.4.4 Image Licenses

Image licenses are licenses required for image conversion done by the links. The image types needing a license are:

- Postscript
- PCL
- GIF

Every time a TC/Link does file conversion this action is registered on TCOSS. If a registration is already used for the workstation hosting the TC/Link, it will be used again. If there is no registration available, the conversion will not be done.

12.4.5 Directory Synchronization and File Type Recognition

Directory synchronization is licensed per system.

12.5 Server Licensing

There's a license for every single server feature you want to use.

12.5.1 Channel Licenses

There are multiple types of different channel licenses:

- FAX over IP channel licenses
- FAX channel licenses
- FAX/VOICE channel licenses
- VOICE channel licenses
- VOICE over IP channel licenses
- TELEX channel licenses
- SMS channel licenses

A FAX channel license for x fax channels allows the use of x fax channels on TCOSS. The same principle applies to the VOICE and the TELEX channel license.

A FAX/VOICE channel license allows the use of a fax or a voice channel.

An SMS channel license allows you to operate a GSM box connected to TCOSS by a TC/Link-WM. There is no license necessary for using the TC/Link-WM, the SMS channel is licensed per GSM box.

Missing channel licenses: If there are more channels configured than licenses present, only the licensed channels operate, the other display an error.

Important: Channel licenses are exclusively consumed by channels on TCOSS, no Link server or TFC application uses up a channel.

12.5.2 Tandem Status Agent

If TCOSS has been configured as a tandem system, the system will check if a tandem status agent license exists. Otherwise TCOSS will run in restricted mode (all channels stop). After the license if provided, TCOSS must be restarted to leave the restricted mode.

12.6 TC/Archive

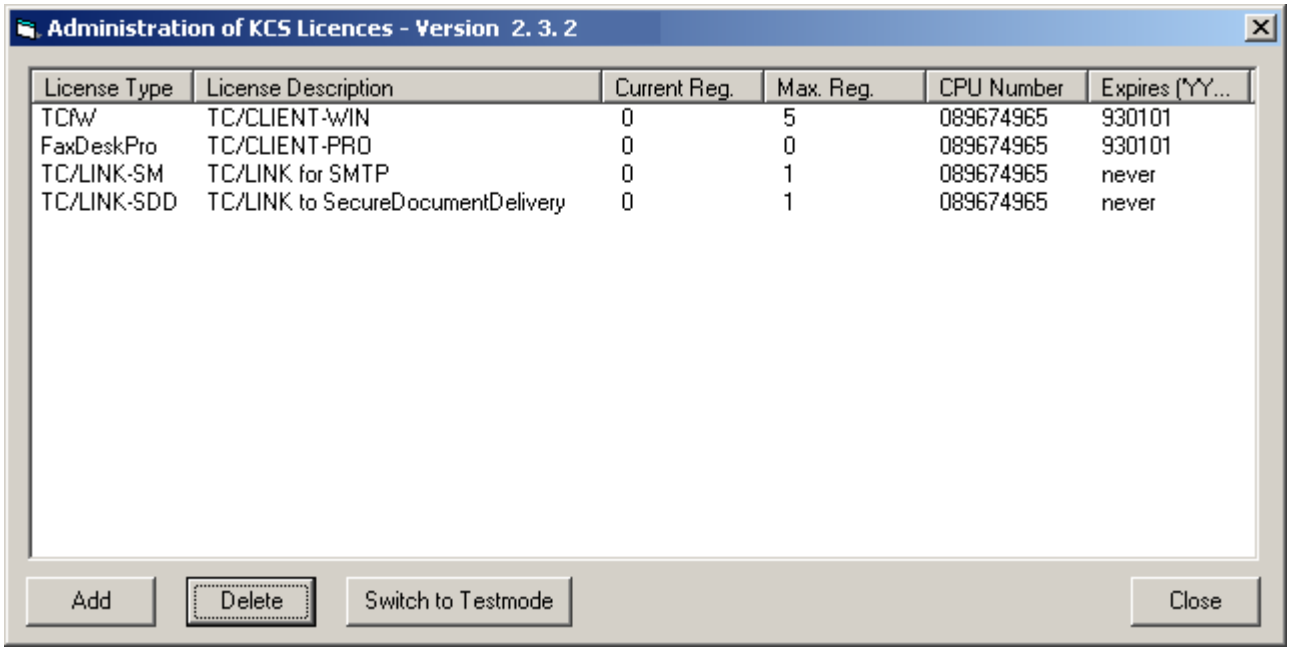
There is no difference if TC/Archive is running on TCOSS, KCS hardware of third-party hardware. There is only one type of archive license, which allows the use of a certain number of workstations hosting TC/Archive. This archive license is calculated (like all other licenses of the new licensing model) with the TCOSS CPU number.

12.7 Jukebox License

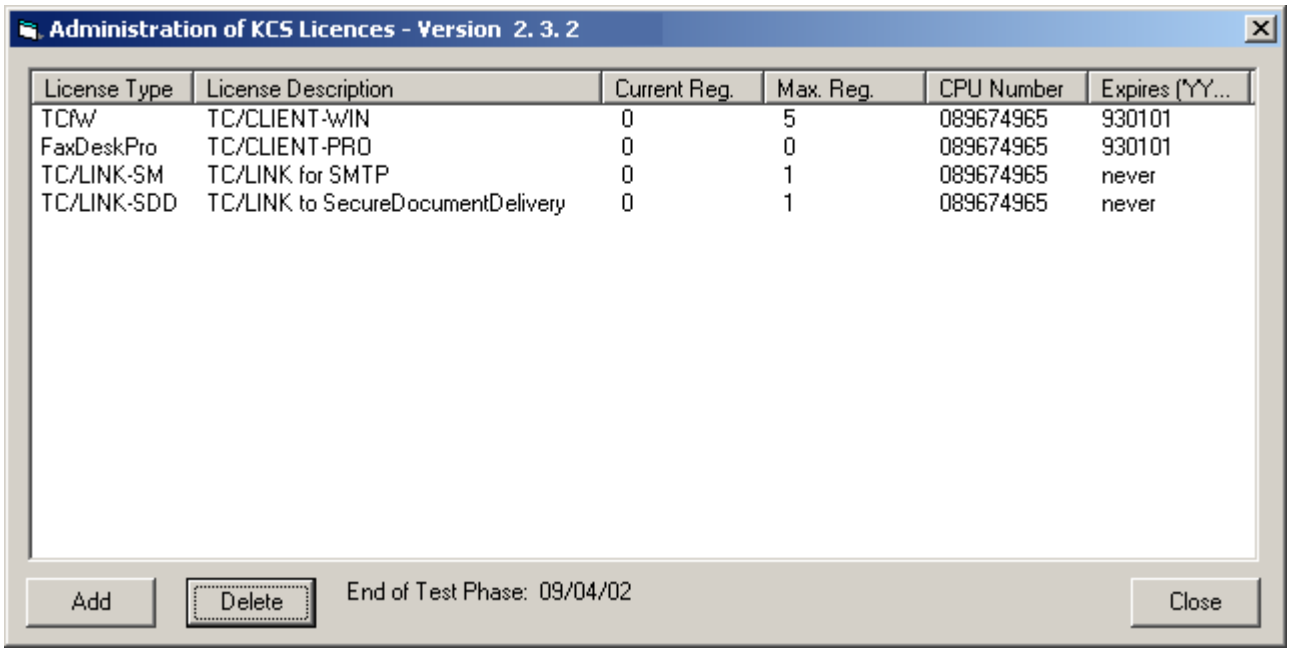
The Jukebox license is calculated with the CPU number of TCOSS.

12.8 Test Mode

Test mode allows operation of a KCS system without appropriate license keys for a limited period of time.



If the “Switch to Testmode” button is clicked, TCOSS will switch into the licensing test mode. This mode disables all license checks for a test phase of 7 days. The test phase is followed by a recovery phase of 30 days with regular license checking. Within this recovery phase it is not possible to switch TCOSS into the test mode again.



During the test mode licenses.exe displays the end of the test mode phase instead of the “Switch to Testmode” button.

12.9 License Keys Type 1

Short Name	Description	License count
TC/METAMAIL	TC/MetaMail	per system
TC/TCFW	TC/Client-Win	per user
TC/JAVA	TC/CLIENT-WEB	per user
TC/REPORT	TC/Report	Per workstation
TC/POST	PostScript Converter	Per workstation
TC/PCL5	PCL5 Converter	Per workstation
TC/GIF	GIF Converter	per workstation
TC/LINK-SM	TC/LINK for SMTP	per workstation
TC/LINK-X4-I	TC/LINK-X4-I with ISOCOR	per workstation
TC/LINK-FI	TC/LINK-FILE Interface	per workstation
TC/LINK-MQ	TC/LINK – for Message Queue	per workstation
TC/LINK-SJ	TC/Link- for HP ScanJet	per workstation
TC/VLink	KCS VoiceLink	per workstation
TC/LINK-MD	Mobile Data Link for SMSC	per workstation
TC/JCD	Archive Jukebox/CD Writing	number of slots
TC/LINK-MFP	TC/LINK for MFPs	per user

12.10 Licenses Type 2

	Description	License count new system
Short Name	TFC (KCS Foundation Classes)	per system
TC/DSc	Directory Synchronization	per system
TC/MWA	Message Wait Agents	per system
TC/LINK-MX	TC/LINK for Exchange	per user
TC/LINK-MX7	TC/LINK for Exchange 2007+	per user
TC/LINK-LN	TC/LINK for Lotus Notes	per user
TC/LINK-SC	TC/LINK for SAP Connect	per 3 instances
TC/LINK-SC7	TC/LINK for newer SAP	per 3 instances
TC/LINK-SI	TC/LINK for SAP Integration	per 3 instances

12.11 Licenses Type 3

Short Name	Description	License count
TandemAgent	Tandem Status Agent	per system
Least Cost	Least cost routing	per system
EMailReader	EMail Reader	per system
VoiceAttend	Voice Attendant	per system
TC/SNMP	SNMP Support	per system
TC/FIREWALL	Messaging Firewall	per system
TC/Probe	Probe messages agent	per system
TC/PLAYER	TC/PLAYER	per user
Fax Channel	Fax Channel	per channel
VoiceChannel	Voice Channel	per channel
Fax Voice	Fax & Voice Channel	per channel
VoIP Channel	Voice IP Channel	per channel
Tlx Channel	Telex Channel	per channel
T.38 Channel	Fax over IP channel	per channel
TC/LANPrint	TC/LAN Print	per workstation
IP Printer	IP Printer	per workstation
TC/BreakMsg	TC/Break Message	per workstation
TC/LINK-SDD	TC/LINK to Secure Document Delivery	per workstation
TC/LINKFI100	TC/LINK File-Interface 100	per workstation, 100 messages per day limitation
TC/LINK-X4	TC/LINK-X4 without ISOCOR	per workstation
T.37 for SM	T.37 for TC/LINK-SM (store & forward)	per workstation
TC/DVD	DVD Jukebox	per workstation
TC/LINK-XML	XML support for Link FI and MQ	per workstation
KCS-KCC	Kofax Capture Connector	per workstation
SMS channels	Former Link-WM	per GSM-Box
TC/MA	TC/Messaging Analyzer	per workstation
TC/digiSign	TC/digital signature	per workstation

12.12 Troubleshooting

The entered licenses can be checked and modified using licences.exe; the entered registrations can be checked and modified with the administrative functions of the client program TCfW.

12.12.1 System Failure

All licenses that are calculated with the TCOSS CPU number are valid 14 days after a CPU number change (for a single server hardware change). For a tandem server where the secondary server temporarily is the master, the licenses are valid for 61 days.

Only link server and archive server licenses are calculated with the local CPU number instead of the TCOSS CPU number. If those servers have to be replaced, the TC90/TC95 of the old system has to be used in order to keep the KCS CPU number. If the TC90/TC95 is replaced, new license keys are required. The 14-day limit is not applicable for these licenses.

12.12.2 Temporary Licenses

If a temporary license is used, TCOSS generates error messages (TE???? files) 14 days before expiration. One message per day is generated. This applies for all licenses maintained by TCOSS.

13. Appendix A

CONSUMER INFORMATION AND FCC REQUIREMENTS

- This equipment complies with Part 68 of the FCC rules. On the rear side of this equipment is a label containing, among other information, the FCC registration number and Ringer Equivalence Number (REN) for this equipment. If requested, provide this information to your telephone company.
- The REN is useful to determine the quantity of devices you may connect to your telephone and still have those entire devices ring when your number is called. In most, but not all areas, the sum of the RENs of all devices should not exceed five (5.0). To be certain of the number of devices you may connect to your line, as determined by the REN, you should call your local telephone company to determine the maximum REN for your calling area.
- If your KCS message server causes harm to the telephone network, the Telephone Company may discontinue your service temporarily. If possible, they will notify you in advance. But if advance notice is not practical, you will be notified as soon as possible. You will be advised of your right to file a complaint with the FCC.
- Your telephone company may make changes in its facilities, equipment, operations, or procedures that could affect the proper operation of your equipment. If they do, you will be given advance notice so as to give you an opportunity to maintain uninterrupted service.
- If you experience trouble with this equipment, like delayed messages or blocked lines, please contact your local Kofax distributor or Kofax directly, A-1232 Vienna, Austria, Phone +43 1 86353-0, Fax +43 1 86353-21, for repair/warranty information. The telephone company may ask you to disconnect this equipment from the network until the problem has been corrected or you are sure that the equipment is not malfunctioning.
- There are no repairs that can be made by the customer to the KCS message server system.
- This equipment may not be used on coin service provided by the telephone company. Connection to party lines is subject to state tariffs. (Contact your state public utility commission or corporation commission for information).
- Allowing this equipment to be operated in such a manner as to not provide for proper answer supervision is a violation of Part 68 of FCC’s rules.
- Proper answer supervision is when:
- This equipment returns answer supervision on all DID calls forwarded to the PSTN.
- Permissible exceptions are:
  – A call is unanswered

14. Appendix B: KCS Approvals and Standards Conformance

14.1 Model 305 (All Components), Model 304 and 350

14.1.1 CE

Safety Standards:

- EN 60950:2000
- CB Scheme for IEC 60950:1999
- UL 1459 third edition (pending), UL94V-0

EMC Standards:

- EN 55022+A1, EN55024+A1, EN61000-3-2, EN61000-3-3+A1
- FCC CFR47 Part 15 Class A

14.1.2 Quality Standard

ISO 9001

14.1.3 ISDN Basic Rate Modem Line Interface Module TC23

TBR3

14.1.4 ISDN Primary Rate Modem Line Interface Module TC24

TBR4

14.1.5 JATE Certification

Model 305 (LineServer, LS1) is certified by the Japan Approvals Institute for Telecommunications Equipment (JATE, http://www.jate.or.jp/english/index.html).

14.2 Model 202 (All Components)

14.2.1 CE

Safety Standards:

- EN 41003:1993, EN 60950:1992 + A1:1992 + A2:1993 + A3:1995 +A4:1996
- CB Scheme for IEC 950:1991 + A1:1992 + A2:1993 + A3:1995 +A4:1996

- UL 1459 third edition, UL 1950 third edition, CSA C22.2 No. 950 (No. 225-M90 for RAID and Model 202), UL94V-0

EMC Emission Standards:

- EN 55022, CISPR 22, FCC Part 15, Subpart B, Class A, EN 50081-1:1992, 60555 Parts 2 + 3

EMC Immunity Standards:

- EN 50082-1:1992

14.2.2 Quality Standard

ISO 9001

14.2.3 System Cabinet

Mechanical layout matches 19” standard DIN 41494

General and Security Approvals: IEC950 (VDE0805), EN60950, UL, CSA, CE1997

EMV Approvals: EN55022-B, EN50082-2, VDE 0871-B

14.2.4 Analogue Modem Line Interface Board TC32

ETS 300.001:1997, TBR 21 (Draft, July 1995) (Analogue Network Standards), FCC Part 68

Fax Group 3:	CCITT T.4, T.6 and T.30
Data Transfer:	CCITT V.17, V.21, V.27ter, V.29 and V.33

14.2.5 PBX Modem Line Interface Board TC31

FCC Part 68

PBX Link: E&M / EIA/TIA 464 B, Bell DID

Fax Group 3:	CCITT T.4, T.6 and T.30
Data Transfer:	CCITT V.17, V.21, V.27ter, V.29 and V.33

14.2.6 ISDN Basic Rate Modem Line Interface Board TC33

ETSI / Euro-ISDN, 1TR6, ECMA/QSIG

ISDN Interface Protection: ETS 300 047-3

ISDN interface: Interface structure CCITT I.412

D-channel protocol: CCITT I.430 / ETS 300 012 layer 1

CCITT Q.921 / ETS 300 125 layer 2

CCITT Q.931 / ETS 300 102-1 ⎫

ETS 300 102-2 } layer 3

ETS 300 062 ⎭

ETS 300 063 } Direct Dialing In

ETS 300 064 }

14.2.7 ISDN Primary Rate Line Interface Board TC34

Protocols: E1, T1/PRI

DSS1 (Euro-ISDN / NET3 / ETSI)

AT&T (USA)

PABX QSIG (ECMA)

E1:

· ETS 300 011 ISDN Primary Rate User-Network Interface Layer 1 spec. and test principles

· ETS 300 046 ISDN Primary Rate Access - safety and protection

T1:

· ANSI T1.403 Network-to-Customer Installation - DS1 Metallic Interface

· ANSI T1.408 ISDN Primary Rate - Customer Installation Metallic Interfaces Layer 1 Spec.

· AT&T TR41459 AT&T Network ISDN Primary Rate Interface and Special Application Spec.

· CE iCTR4 (PRI ISDN)

14.2.8 Telex Interfaces TS20, 22, 26, 28

Exchange types:	CCITT U.1 type A and B
Telex interfaces:	XD, Single current, double current and V.21

14.2.9 RS-232 Interfaces

V.24 Signal Level

15. Post Installation Checklist

Post Installation Checklist

15.1 Goal

Make sure that after a successful installation/ integration phase, the KCS system will work properly after years as well. Visit the customer 4 to 8 weeks after the installation has been finished.

15.2 Check

Inbound distribution queue processed by operator
Backup of users, addresses and services
Backup of important system files (Arr99, ANN99, Auu99, AVV99, Akk99,)
Backup of masks, covers and templates
Backup of the FIS folder (if used)
Check TCfW unfiltered in and outbox with
Check disk usage, especially the unconfirmed part (is the auto termination flag enabled for messages forwarded to the mail system)
Check the ATExxxx messages
Check the event logs (application, system and security) from all KCS servers (Tcoss-, Link-, Archive- and Voice-servers)
Check for DRWTSN32.LOG files on all KCS servers (Tcoss-, Link-, Archive- and Voice- servers)
Check the free disk space on all KCS servers (Tcoss-, Link-, Archive- and Voice- servers) - all volumes - especially for temporary files left on the system(s)
Check the KCS journal files (outbound and inbound for possible send and/ or reception problems)
Note down the license keys, especially for temporary licenses the expiration date
Check if the trace output (trace level settings) are not too high for normal operation
Check the temperature of all KCS servers (just touch the cabinet – is it too hot?)
Check for strange noise (FAN blocked by flat cable- HDD noise, …)
Check if you have the proper documentation of the customer installation archived in your office (release numbers, WCONFIG, registry exports, services, Arr99, short description about the installation, description of special workflow, and special changes like MAP files…..)
Document jumper settings on interfaces, serial numbers and release numbers of interfaces, release of installed drivers
Check if cables connected to KCS have a unique description (LAN, ISDN + number) and if the connectors on KCS are described as well
Inform the KCS administrator(s) of the customer to perform periodic backups of users, addresses, services, important system files (Arr99, ANN99, Auu99, AVV99, Akk99,), masks, covers, templates and the FIS folder (if used)

16. Appendix C /GERMAN

Safety Instructions translated to the native language of the country where the system will be installed.

Sicherheitshinweise, unbedingt aufheben!

Lesen Sie alle Hinweise, bis Sie sie verstehen!

Befolgen Sie alle Hinweise und Warnungen am Gerät!

Verwenden Sie das Gerät nicht in der Nähe von Wasser oder in einem feuchten Keller.

Stellen Sie das Gerät nicht auf einen Wagen, Ständer oder Tisch, wenn diese keine ausreichende Stabilität aufweisen. Das Gerät könnte herunterfallen und schwer beschädigt werden!

Schlitze und Öffnungen im Gehäuse sind zur Belüftung vorgesehen, um das Gerät vor Überhitzung zu schützen. Diese Öffnungen dürfen nicht abgedeckt oder verschlossen werden. Das Gerät sollte niemals nahe oder über einem Heizkörper aufgestellt werden. Das Gerät sollte nicht eingebaut werden, solange nicht für ausreichende Ventilation gesorgt ist.

Dieses Gerät darf nur von einer Stromquelle betrieben werden, die der Aufschrift am Typenschild und der Einstellung des Spannungswahlschalters am Netzgerät entspricht.

Stellen oder legen Sie nichts auf das Stromversorgungskabel. Platzieren Sie das Gerät nie so, dass jemand auf das Stromkabel steigen könnte.

Achten Sie darauf, dass weder der Wandanschluss noch ein Verlängerungskabel überlastet werden. Dadurch könnte Brandgefahr oder die Gefahr eines elektrischen Schlages entstehen.

Stecken Sie niemals Dinge beliebiger Art durch Gehäuseschlitze in dieses Gerät. Sie könnten damit gefährliche Spannungen berühren oder Teile kurzschließen und dadurch Brandgefahr oder die Gefahr eines elektrischen Schlages auslösen.

Das Gerät darf nur durch autorisierte Personen geöffnet werden.
Vorsicht Hochspannung!

Trennen Sie das Gerät durch ziehen des Netzsteckers vom Netz und fordern Sie qualifizierte Servicetechniker unter folgenden Umständen an:

- **Wenn das Stromversorgungskabel oder ein Stecker beschädigt oder durchgescheuert sind.**
- **Wenn Flüssigkeit in das Gerät eingedrungen ist.**
- **Wenn das Gerät Regen oder Wasser ausgesetzt war.**

- **Wenn das Gerät trotz Befolgen der Bedienungsanleitung (System Manual) nicht ordnungsgemäß funktioniert, benützen Sie nur jene Einstellmöglichkeiten, die in der Bedienungsanleitung angeführt sind, denn unsachgemäße Einstellung anderer Kontrollmöglichkeiten kann zur Zerstörung des Gerätes führen und verursacht oftmals einen unnötig hohen Aufwand für qualifiziertes Servicepersonal, um das Gerät wieder in Gang zu setzen.**
- **Wenn das Gerät fallen gelassen wurde oder das Gehäuse beschädigt wurde.**
- **Wenn das Gerät eine auffallende Änderung in der Leistungsfähigkeit aufweist.**

Vollkommene Netztrennung nur durch Ziehen aller vorhandenen Netzkabel!

Die Stromversorgung des Gerätes darf nur getauscht oder repariert werden, wenn das Gerät ausgeschaltet ist und alle Netzstecker gezogen sind.

Die Netzsteckdose muss nahe beim Gerät und leicht zugänglich sein.

Zur Stromversorgung des Gerätes verwenden Sie bitte ein flexibles Kabel mit 1,5-4m Länge und einem Schutzleiter. Das Kabel sollte mindestens für 230V/6A zugelassen sein. Der Erdleiter darf keinen kleineren Querschnitt als die Versorgungsleiter aufweisen. Blanke, beschichtete oder isolierte Erdleiter können eingesetzt werden. Einzeln beschichtete oder isolierte Erdleiter müssen eine dauerhafte Farbgebung in grün, oder grün mit einem oder mehreren gelben Streifen aufweisen.

Die Stromanschlussstecker in der Umgebung des Gerätes müssen alle einen intakten Erdanschluss aufweisen.

Das Gerät ist ausschließlich zur Installation in Räumen mit beschränktem Zutritt gedacht.

Das CD-Laufwerk (wenn vorhanden) entspricht Laser Klasse 1 und entspricht der US-Norm 21 CFR Subchapter J.

VORSICHT!
Explosionsgefahr bei unsachgemäßem Austausch der Batterie.
Ersatz durch denselben oder einen vom
Hersteller empfohlenen gleichwertigen Typ.
Entsorgung gebrauchter Batterien nach
Angaben des Herstellers.

VORSICHT!
Dies ist eine Einrichtung der Klasse A. Diese Einrichtung kann im Wohnbereich Funkstörungen verursachen; in diesem Fall kann vom Betreiber verlangt werden, angemessene Maßnahmen durchzuführen.