

# Thin client evaluation and demonstration

1.0

Sundsvalls kommun

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Dokumentet skapat  
2002-01-17

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# 1 FOREWORD

## 1.1 CLIENT

This test was initially ordered by Daniel Antonsson, from the Education department at Sundsvalls kommun. The purpose of the test was to evaluate the best thin client solutions for the education and administration departments at Sundsvalls kommun.

### 1.1.1 FOREWORD FROM THE CLIENT

Since 1995 we, at Sundsvalls kommun have used a Citrix / Terminal server environment for our administration. The environment is based on products from Microsoft and Citrix. We use this environment as our production system and run all of our standard applications (i.e. Microsoft Office etc...). In 2001 we developed a second Citrix / Terminal server environment to support the education division.

Up until this point we had always used standard PC's as workstations. Due to the increasing range of terminals available on the market, we began to evaluate them to replace our PC's.

During the last year we performed some tests of a variety of different terminals. From these small tests we developed a greater interest in terminals and desired a larger test of different terminals and terminal types. We discussed this with TeleComputing and ordered the terminal test from them. The result of this test is the document that you are now currently reading.

Through TeleComputings involvement, interest and contacts on the market, the study grew to a size that never could have imagined from the beginning.

We would like to thank everyone who has helped us with this project, distributors, manufactures and everyone else.

For us has this study given us a greater knowledge about thin clients and we have today a much easier way to select the terminal type(s) that best fit in our environment and the meet our needs.

We sincerely hope that you will find this study a very interesting and helpful tool.

Daniel Antonsson  
IT-strateg Sundsvalls kommun education

### 1.1.2 FOREWORD FROM TELECOMPUTING

My name is Kent Söderlund and I am the area business manager for TeleComputing in the northern part of Sweden. When making these tests I have used my own personal knowledge of the Terminal server environment, both from a consultant point of view

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and most importantly from my knowledge as the IT manager at Sundsvalls kommun just two short years ago.

I have been working with Citrix solutions since 1995, as an IT manager, consultant and project leader for both large and small Server Based Computing solutions.

Telecomputing, my current employer is the perfect company and allows me to use my extensive experience with terminal solutions. I truly enjoy Server Based Computing (SBC) solutions and it is great to work for a company that is 100% focused on delivering high quality, low cost, and centrally managed IT solutions based on Microsoft and Citrix technology.

This test has been a very interesting project for me and all of us here at Telecomputing would like to thank Sundsvalls kommun for giving us the opportunity to do this for them. Initially we had 3 or 4 different terminals and the purpose was to test them for Sundsvalls kommun. But after discussing this test with many of our suppliers and vendors that we have on the market, I found that the interest for this test was extremely high and the support we received was incredible. Many of our suppliers wanted us to include their terminal in our tests to see how it would perform. By the end of this test ended up with many more terminals than initially intended, but the results that emerged were truly global and clearly showed the pros and cons of many top terminals today.

I would especially like to thank the distributors Data Construction and AKS who helped us a lot to get all the terminals. Konfac Data in Sundsvall, who delivered some of the terminals and assisted us with pricing. We would also like to thank Dimension in Sundsvall who helped us with configuration and prices for the Sun terminals.

The interest from the market was much larger than we initially thought. From the beginning only Sundsvalls kommun showed a real interest of replacing PC's with terminals, and now there have been over 250 different companies and organizations around Sweden who have ordered this document.

I hope that this document will give you some help in your decision regarding on which terminal or terminals are right for your organization.

If you have any questions, please do not hesitate to email me or give me a call.

Kent Söderlund

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## 1.2 THE TESTED TERMINALS

The following is a list of manufactures of the terminals that we tested. TeleComputing AB and Sundsvalls kommun would really like to express our gratitude for their work to help make this test possible.

The manufacturers:

- Wyse [www.wyse.com](http://www.wyse.com)
- Acer [www.acer.com](http://www.acer.com)
- ChipPC [www.chippc.com](http://www.chippc.com)
- Compaq [www.compaq.com](http://www.compaq.com)

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- IBM [www.ibm.com](http://www.ibm.com)
- NCD [www.ncd.com](http://www.ncd.com)
- SUN [www.sun.com](http://www.sun.com)
- Fujitsu/Siemens [www.fujitsu-siemens.com](http://www.fujitsu-siemens.com)

### 1.3 THE MANUFACTURES

All of the manufactures received the pre-study document to inform them of what we were planning on testing. It was left completely up to each manufacturer to send us the terminal that they wanted to participate in these tests, as well as any feature software, accessories and so on. This was a disadvantage for some of the manufacturers due to the fact they did not always send us all of the necessary peripherals that we needed. For example, only one manufacturer sent us a terminal with a smart card, other manufacturers also support smart cards, but could not be tested. Another big disadvantage is that most of the terminals are only equipped with USB ports for keyboard, mouse, LPT and COM ports and the manufacturers did not send us any type of adapters (i.e. USB to serial and USB to parallel adapters).

### 1.4 THE DIFFERENT TERMINALS

One thing is quite clear after performing these tests. All of the terminals have nearly the same performance. Some of the tests that we planned we decided to skip. All the terminals produced relatively the same test result. The most important aspect regarding the performance is dependent on the server itself, where all the processing is done.

After examining the terminals we discovered three issues that separated the terminals:

- Features
- Management Tools
- Price

Together with this document you should also receive two Excel (.xls) files. These files show all of the information about the different terminals tested.

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## 2 OPERATING SYSTEM

The terminals tested had one of three different operating systems described briefly below:

### 2.1.1 WINDOWS CE

Most of the terminals have Windows CE 2.12 and one had Windows CE 3.0. When we looked at performance, we didn't find any differences between these two.

One disadvantage with CE 3.0 was that it did not include the latest Citrix client (6.0.985), which includes the latest MetaFrame XP features.

One major disadvantage with CE is that it isn't possible to upgrade the Citrix client from the Citrix website and install it. You must wait until that the vendor releases it and use the upgrade tools provided by each terminal.

### 2.1.2 WINDOWS NTE

This is a thin version of Windows NT4. We were really surprised that the terminals running this OS didn't perform better than the terminals running Windows CE. We also find many disadvantages with NTE. The "Hard disk" is too small, for example it wasn't possible to install most of the printers locally because they didn't fit in the "hard disk". We discovered some strange behavior regarding the graphics card in both terminals tested. At times, 25 percent of the screen would simply change into another color. One major advantage of NTE is that it includes a "modern" integrated web browser, Internet Explorer 5.5.

### 2.1.3 LINUX

Some of the terminals had different version of Linux. The performance was as we said above, quite the same and you administer them in almost the same way. They are equipped with a local browser, but the browser included could give some companies a bit of trouble, it includes a Netscape browser. Of course, if the organization uses Netscape as their default browser then Windows CE and Windows NTE will produce the same problem. Today, Internet Explorer is the most widely used web browser.

## 2.2 DISADVANTAGES / ADVANTAGES

### 2.2.1 WINDOWS CE

#### 2.2.1.1 ADVANTAGES

- Easy to manage from a central location.
- Fast boot time

#### 2.2.1.2 DISADVANTAGES

- Internet Explorer 4
- Impossible to download and install the latest clients from Citrix

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- Impossible to use Citrix client distribution tools
- Extremely difficult to use locally attached devices if the terminal has USB only. We have not been able to get a locally attached HP DeskJet with USB to work on any CE/USB device.

## 2.2.2 WINDOWS NTE

### 2.2.2.1 ADVANTAGES

- Allows the possibility to install software and use software "locally".
- Internet Explorer 5.5
- Easy to upgrade to the latest Citrix clients.
- Easy to attach to network printers.

### 2.2.2.2 DISADVANTAGES

- Very slow boot time.
- The hard disk space is small and limiting making it impossible to use most printers locally.
- Every now and then the operating system requests the NT4 CD. For example when installing printers locally, changing the system locale to Swedish etc....
- Difficult to manage centrally.
- Difficult or impossible to reinitialize and restore the local settings from a central point.

## 2.2.3 LINUX

### 2.2.3.1 ADVANTAGES

- Fast
- Easy to locally install the latest clients from Citrix

### 2.2.3.2 DISADVANTAGES

- Only ICA is supported. There is currently no support for RDP (on most of the terminals).
- Local browser is Netscape, could present a problem for some organizations.
- Slow boot time.
- For many organizations is Linux not "well known" operating system.

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### 3 TERMINALS OR PC

One important aspect of this test was to see if there is any advantages or disadvantages for using old PC's instead of terminals, or vice versa. We tested three different PC operating systems. All of the PC's tested had a Pentium 90MHz processor and 32MB RAM.

#### 3.1 TERMINALS

##### 3.1.1 ADVANTAGES

- Easy to manage.
- Easy to replace if stolen.
- Absolutely silent.
- They can be used in dirty environments.
- No risk for viruses because there is no local disks.
- Low risk for theft. Have no components that can be sold.
- Extremely high MTBF (mean time between failure). For example the NCD ThinSTAR has over 300.000 hours of between failures.
- Very low power consumption.

##### 3.1.2 DISADVANTAGE.

- It's an investment if you already have PC's
- Some of them are expensive when compared to PC's.
- It's not possible to change back from a terminal environment.
- Some of the manufacturers are small companies and it's important to be sure that they are going to be in the market in the future.
- No possibility to access information from locally attached diskettes or CD-ROMS. (Could also be an advantage).
- No possibility to attach local devices, for example scanners, CD-Burners etc....

#### 3.2 PC'S AS A TERMINALS

##### 3.2.1 ADVANTAGES

- Inexpensive if you already own older PC's.
- Possible to change parts and upgrade even if the manufacturer isn't still on the market.
- Possibility to have local diskettes and CD-ROM.
- Possibility to have additional local devices, for example scanners, CD-burners etc...

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### 3.2.2 DISADVANTAGES

- Noisy
- Difficult to manage from a central location.
- Easily broken and could be difficult for the end user to repair or change.
- Moving parts which could be a problem in a dirty environment.
- Great possibility that the end user could "mess up" the local operating system.
- Are risk for viruses if the end user is allowed to attach local devices

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## 4 THE TEST ENVIRONMENT

### 4.1 SERVER

Compaq Proliant 300  
Dual Pentium II 500MHz  
256MB RAM

### 4.2 OPERATING SYSTEM

Windows 2000 Server SP2

### 4.3 CITRIX METAFRAME VERSION

Citrix MetaFrame XPe with SP1/FR1

### 4.4 NETWORK

100Mb Switched Ethernet

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## 5 MANAGEMENT TOOLS

The tested Management Tools are:

- NCD
- Wyse Rapport
- ChipPC Xcalibur
- Neoware
- Fujitsu/ Siemens
- IBM

### 5.1 RESULT

From our point of view we found three “winners” that we have made some additional comments on (see below). The management systems from IBM, Neoware and Fujitsu/Siemens did not reach the highest level and are more difficult to use and provides less administration than the other tools listed above.

#### 5.1.1 CHIPPC XCALIBUR

This was our favorite. You could manage absolutely “everything” on the device using this tool. It’s easy to install and learn to use. You get much more information on the screen about every aspect of your terminals in “real time”, e.g. if a particular one is switched on, which ones are in setup mode (the user has pressed the setup (F2) key on the terminal) and so on, and so on!

Xcalibur is built on a SQL database (SQL server or the runtime of SQL server, which is delivered with the system). You may install it on a machine with Microsoft Internet Information server (IIS), which make it possible to administer all of your terminals from any machine using a any web browser located on your LAN/WAN.

If you purchase a new terminal you can enter in that terminals specific MAC address in Xcalibur and it will automatically configure the terminal with the correct setup information when the terminal is turned on.

ChipPC has also had the best Smart Card solution that we have seen and there are many setup choices available for setting up the Smart Cards in Xcalibur.

#### 5.1.2 NCD

NCD’s management software is also very easy to use. It performs its job quite well and you can easily use the software to administer your terminal effectively. As with ChipPC you can attach to the terminal in real time and help the user “live”. When you purchase a new terminal you configure in the

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setup the servers IP address on that terminal and it will automatically be configured when it switched on. NCD has the best solution when it comes to upgrading the operating system and installing add-on software on the terminal. You simply tell the system which terminals (easiest on MAC address level) need to have the latest software and it will automatically be downloaded and installed when the terminal is switched on. You can also, of course, as with most of the terminals, perform a Wake-On-LAN, upgrade the system and then switch it off again.

### 5.1.3 WYSE RAPPORT

At first sight you can see that this software has been around for a long time, and that is good news, don't think anything else. It's a modern software package, and the reason for the first comment is that it simply works. Plus it's robust and very easy to install!

We are sure that Rapport will do the work for you. It's a little bit more difficult to upgrade the terminals than NCD; you also may not run it from any computer on your LAN/WAN as with Xcalibur. You could, of course, install ICA or RDP on the Rapport server, attach and configure any terminal.

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## 6 TESTING PARAMETERS

### 6.1.1 THE TERMINAL TEST

Some of the tests that were mentioned in the pre-study documents have been discarded because the performance was mostly dependent on the server and give the exact same result for all terminals.

#### 6.1.1.1 STARTUP TEST

Cold boot = take out the power cord and reattach it and power on  
Warm boot = switch off with the power or, if exist, the standby switch

Will test the time to do a "cold" boot and a "warm" boot, both to the connection manager and to the Terminal server login with auto logon on the terminal. This test will be performed with both ICA and RDP.

#### 6.1.1.2 POWERPOINT TEST

Will start a PowerPoint presentation with 50 slides with some multimedia effects included and measure the time it takes to click through all of the slides.

#### 6.1.1.3 PICTURE TEST

We will show some digital photos and rate the quality. The photos were approximately 600K in size, and the most interesting thing is how fast they appear on the screen as well as the quality. A rating of 5 is given if the quality is the same as if running on the server and a rating of 1 was given if the picture could not be displayed at all.

#### 6.1.1.4 SOUND TEST

We will play an MP3 song on each terminal and rate the sound quality, without external speakers. A rating 5 was given if the quality was the same as if running on the server, and rating of 1 was given if was not possible to here anything at all.

#### 6.1.1.5 VIDEO TEST

We will play a video (.avi) on the terminal and rate the quality. A rating of 5 was given if the quality was the same as if running on the server; a rating of 1 was given if it was not possible to hear or see anything at all.

#### 6.1.1.6 LOCAL PRINTER TEST

Test the functionality to print to a locally attached printer from the Terminal server / Citrix environment.

#### 6.1.1.7 LOCAL COM TEST

We will test the functionality to attach a PDA with the local COM port on the client.

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### 6.1.2 THE FEATURE TEST

We will test the different features that exist on the terminal. On all terminals we tested the following:

- Integrated WEB browser
- Integrated terminal emulation
- Smart Card login

One test we attempted was testing the infrared communication to, for example sync with a PDA. Because CE doesn't support IRDa from the client to the PDA we were forced to skip that test.

### 6.1.3 WAKE ON LAN TEST

Will test if it's possible to "wake" the terminal from the management tool?

### 6.1.4 SNMP TEST

Will test if the terminal could send SNMP traps to a management tool.

### 6.1.5 MANAGEMENT TEST

Will describe witch management tool, if any, the terminal could be managed with.

### 6.1.6 PRICES

Will give the "street" price for the terminal. Beware that all of the manufacturers have other prices for various quantities. The prices shown are for one device. If the manufacturer has a special education price we will enter as well.

- One piece "street" price:
- One piece "education" price:

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## 7 TERMINAL COMMENTS

Below we have written some additional comments regarding a few of the tested terminals. For the complete test result see the .xls files.

### 7.1 WYSE WINTERM 1200 LE

This is a really nice and inexpensive terminal for the right environment. It's extremely fast to boot up and login with. It only includes the ICA client, no RDP, so it can't be used in an environment without Citrix. We found two disadvantages with it, first it doesn't include any management tools, yet. Wyse has promised that with the new release of Rapport (3.02) it should be possible to manage this terminal as well. We haven't seen it, so therefore we don't know what exactly you are going to be able to do with it. The other possible disadvantage is that it is the only terminal on the market with it's own, propriety operating system. What happens if Wyse choose to drop it?

### 7.2 XTREME PC

I have to admit, this is my favorite! It's extremely small, it has a really nice smart card solution, it boots (warm boot) fast, and they have the best management tool. I have received the best support from them as well. They actually flew a support guy from Israel to Sundsvall just to help us implement it correctly. Now that is support! On the Xtreme PC you have the nicest smart card solution that we have seen, you could have a lot of different security levels, you could take out the card on one terminals and insert it on any other terminal on your WAN, and get back to the same place where you left!

### 7.3 SUN RAY ONE

This is really a very different type of solution. When you look at the prices for Sun you must be aware that you need a Sun server on every LAN you want plan to use the terminal. Because of that we have included a Sun server in the price list, so therefore the price is escalated for each terminal. We have given a price that include 1 sun server and 25 terminals. Keep in mind that if you already have a SUN server you would not have to purchase another SUN server if your machine could handle the load from the terminals. You can simply purchase and install the SunRay software and purchase the terminals by themselves or in bulk. Sun has a really nice solution for their smart card solution where you could take out the smart card and reinsert it on another terminal (attached to the same server in the same location) and immediately find yourself at exactly the same place when you left. Disadvantages with this solution is of course that a SUN server is needed, because Sun recommends a separate 100M bit only for the terminals you must of course have one Sun server on every LAN, so this is not a solution if you have locations with only a small amount of users.

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## 8 WHICH ONE SHOULD I CHOOSE?

From our point of view we have come to the following points:

We don't thin it matters if it takes 27 or 42 seconds to switch the terminal on, if it takes 47 or 63 seconds to look at a PPT presentation!

We should choose terminals from the following criteria – and in this order!

1. Make sure that you got the best management tools for your needs!
2. Choose the operating system that best fits your needs!
3. Make a decision if you need a local browser or not!
4. Make a decision if you need a local terminal emulation!
5. Make a decision if you need a smart card solution or not!
6. Make sure you got a reseller that you think has the right knowledge!
7. Look at the price!!

We at Telecomputing sincerely hope that you have found this independent study of terminals helpful and rewarding. We would also like to mention that we are the first, and only company in Sweden that is focused on ASP (Application Service Providing) and SBC (Server Based Computing). If you require any assistance of any kind or would simply like to discuss your terminal server / Citrix environment with one of our specialized consultants, please do not hesitate to contact us. We are here to help you master this new, money saving, and exciting new environment. There are still many questions regarding this technology. However, the question is not "Should I implement a SBC solution?" but rather "When should I?" Thank you for your time and we look forward to your feedback and comments.

	WYSE						NCD		ChipPC				COMPAQ				PC		
	1200LE	3200LE	3230LE	3360SE	8230LE	8360SE	332	500	4410	4430	4610	4630	238137	238138	238139	238140	DOS	LINUX	WIN
OS	WYSE	Win CE	Win CE	Win CE	NTe	NTe	CE 2.12	CE 2.12	CE 3.0	CE 3.0	CE 3.0	CE 3.0	CE	NTe	NTe	NTe	DOS 6.22	RedHat	Win 98
Processor	200MHz	200MHz	300MHz	233MHz	300MHz	300MHz	300MHz	300MHz	166 MIPS	166 MIPS	166 MIPS	166 MIPS	300MHz	300MHz	300MHz	300MHz	P 90MHz	P 133MHz	P 133MHz
Memory FLASH	512K	8MB	16MB	16MB	64MB	64MB	8MB	16MB	16 MB DOC	16 MB DOC	32 MB DOC	32 MB DOC	16 MB	48 MB	64 MB	96 MB			
Memory DRAM	16MB	16MB	32MB	32MB	64MB	64MB	32MB	32MB	32 MB	32 MB	64 MB	64 MB	32 MB	64 MB	96 MB	128 MB	32 MB	32 MB	32 MB
Colours	65K	256	65K	256	65K	65K	65K	65K	16M	16M	16M	16M	65K	65K	65K	65K	256	16M	16M
Max res.	1024x768	1024x768	1024x768	1280x1024	1024x768	1280x1024	1280x1024	1280x1024	1024x768	1024x768	1024x768	1024x768	1280x1024	1280x1024	1280x1024	1280x1024	1024x768		
Max ref Rate	85Hz	85Hz	85Hz	85Hz	75Hz	75Hz	85Hz	85Hz	85Hz	85Hz	85Hz	85Hz	85Hz	85Hz	85Hz	85Hz	85Hz	85Hz	85Hz
Audio -out	16 bit stereo	16 bit stereo	16 bit stereo	16 bit stereo	16 bit stereo	16 bit stereo	16 bit stereo	16 bit stereo	16 bit stereo	16 bit stereo	16 bit stereo	16 bit stereo	16 bit stereo	16 bit stereo	16 bit stereo	16 bit stereo	None	16 bit stereo	None
Auto - in	8 bit mic.	8 bit mic.	8 bit mic.	8 bit mic.	8 bit mic.	8 bit mic.	8 bit mic.	8 bit mic.	8 bit mic.	8 bit mic.	8 bit mic.	8 bit mic.	8 bit mic.	8 bit mic.	8 bit mic.	8 bit mic.	None	8 bit mic.	None
Keyboard	USB	USB	USB	USB	USB	PS/2	PS/2 incl	PS/2 incl	PS/2	PS/2	PS/2	PS/2	USB incl	USB incl	USB incl	USB incl	PS/2	PS/2	PS/2
Mouse	PS/2 incl	PS/2 incl	PS/2 incl	PS/2 incl	PS/2	PS/2 incl	PS/2 incl	PS/2 incl	PS/2	PS/2	PS/2	PS/2	USB incl	USB incl	USB incl	USB incl	PS/2	PS/2	PS/2
Networking	10/100 Eth	10/100 Eth	10/100 Eth	10/100 Eth	10/100 Eth	10/100 Eth	10/100 Eth	10/100 Eth	10/100 Eth	10/100 Eth	10/100 Eth	10/100 Eth	10/100 Eth	10/100 Eth	10/100 Eth	10/100 Eth	10 Eth	10 Eth	10/100 Eth
Expansion slot (3)	No	No	No	No	No	No	Yes	Yes	No	No	No	No	No	No	No	No	Yes	Yes	Yes
USB Ports	2	2	2	1	2	1	0	2	0	0	0	0	4	4	4	4	0	0	0
Par port	0	0	0	1	0	1	1	1	1	1	1	1	0	0	0	0	1	1	1
Ser port	0	0	0	2	0	2	1	2	1	1	1	1	0	0	0	0	1	1	1
ICA Protocol	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
RDP Protocol	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes
Local browser	No	No	IE 4	IE 4	IE 5.5	IE 5.5	No	IE 4	Optional	Optional	Optional	Optional	IE 5.5	IE 5.5	IE 5.5	IE 5.5	None	Netscape	IE 6.0
SmartCard reader	No	Optional	Optional	Optional	Optional	Optional	No	No	No	Yes	No	Yes	No	No	No	No	No	No	No
SmartCard writer	No	Optional	Optional	Optional	Optional	Optional	No	No	No	Yes	No	Yes	No	No	No	No	No	No	No
Terminal emulation	No	Yes	Yes	Yes	Yes	Yes	Optional	Yes	Optional	Optional	Optional	Optional	Yes	Yes	Yes	Yes	No	Optional	Optional
Height (mm)	43	43	43	226	43	226	240	240	34	34	34	34	226	226	226	226	X	X	X
Width (mm)	194	194	194	60	194	60	55	55	158	158	158	158	174	174	174	174	X	X	X
Depth (mm)	157	157	157	174	157	174	281	281	80	80	80	80	99	99	99	99	X	X	X
Weight (kg)	3,5	3,5	3,5	5,5	3,5	5,5	1,3	1,3	0,25	0,25	0,25	0,25	5,5	5,5	5,5	5,5	X	X	X
Power (W)	Not specified	Not specified	Not specified	Not specified	Not specified	Not specified	Not specified	Not specified	3,5	3,5	3,5	3,5					X	X	X
"Street price"	(4) 3 765 kr	(4) 5 060 kr	(4) 5 410 kr	(4) 6 470 kr	(4) 7 530 kr	(4) 8 705 kr	5 200 kr	6 250 kr	5 290 kr	5 880 kr	6 300 kr	6 890 kr	4 561 kr	5 722 kr	6 753 kr	7 783 kr	1 700 kr	2 500 kr	2 500 kr
Statskontors pris	(4) 3 380 kr	(4) 4 540 kr	(4) 4 855 kr	(4) 5 805 kr	(4) 6 755 kr	(4) 7 810 kr							4 164 kr	5 224 kr	6 165 kr	7 105 kr			
Education price	(4) 3 380 kr	(4) 4 540 kr	(4) 4 855 kr	(4) 5 805 kr	(4) 6 755 kr	(4) 7 810 kr	4 650 kr	5 740 kr	4 745 kr	5 270 kr	5 660 kr	6 180 kr							
Options - Browser									195 kr	195 kr	195 kr	195 kr					No	Free	Free
Options - Term emul							480 kr	480 kr	285 kr	285 kr	285 kr	285 kr					No	Differs	Differs
Management softw	N/A	250 kr (2)	250 kr (2)	250 kr (2)	250kr (2)	250 kr (2)	580 kr (5)	580 kr (5)	370 kr	370 kr	370 kr	370 kr	250 kr (2)	250 kr (2)	250 kr (2)	250 kr (2)	No	No	No

	IBM	ACER		Fujitsu	Neoware								SUN
	N2200i	WT300	WT300-R	SCCOVERY	2000e	3000x	3000i	4000t	4000s	4000i	5000e	5000s	Ray 1
OS	TurboLinux	CE	CE	Linux	Linux	CE	CE	Linux	Linux	Linux	NTe	NTe	Solaris
Processor	233MHz	200MHz	200MHz	900MHz	300MHz	300MHz	300MHz	300MHz	300MHz	300MHz	300MHz	300MHz	Not specified
Memory FLASH	32MB	8MB	8MB	32MB	8MB	8MB	16MB	48MB	24MB	16MB	48MB	96MB	Not specified
Memory DRAM	96MB	32MB	32MB	128MB	32MB	32MB	32MB	64MB	64MB	64MB	64MB	128MB	Not specified
Colours (6)	65K	256	256	16M	65K	65K	65K	65K	65K	65K	65K	65K	16M
Max res. (6)	1280x1024	1027x768	1027x768	1600x1200	1280x1024	1280x1024	1280x1024	1280x1024	1280x1024	1280x1024	1280x1024	1280x1024	1280x1024
Max ref Rate (6)		75Hz	75Hz	85Hz	85Hz	85Hz	85Hz	85Hz	85Hz	85Hz	85Hz	85Hz	75Hz
Audio -out	16 bit stereo	16 bit stereo	16 bit stereo	16 bit stereo	16 bit stereo	16 bit stereo	16 bit stereo	16 bit stereo	16 bit stereo	16 bit stereo	16 bit stereo	16 bit stereo	16 bit stereo
Audio -in	8 bit mic.	8 bit mic.	8 bit mic.	8 bit mic.	8 bit mic.	8 bit mic.	8 bit mic.	8 bit mic.	8 bit mic.	8 bit mic.	8 bit mic.	8 bit mic.	8 bit mic.
Keyboard	USB incl	PS/2	PS/2	PS/2	PS/2 incl	PS/2 incl	PS/2 incl	PS/2 incl	PS/2 incl	PS/2 incl	PS/2 incl	PS/2 incl	USB incl
Mouse	PS/2 incl	PS/2	PS/2	PS/2	PS/2 incl	PS/2 incl	PS/2 incl	PS/2 incl	PS/2 incl	PS/2 incl	PS/2 incl	PS/2 incl	USB incl
Networking	10/100 Eth	10/100 Eth	10/100 Eth	10/100 Eth	10/100 Eth	10/100 Eth	10/100 Eth	10/100 Eth	10/100 Eth	10/100 Eth	10/100 Eth	10/100 Eth	10/100 Eth
Expansion slot (3)	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
USB Ports	2	2	2	2	2	2	2	2	2	2	2	2	4
Par port	0	1	1	1	1	1	1	1	1	1	1	1	0
Ser port	0	1	1	1	2	2	2	2	2	2	2	2	0
ICA Protocol	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
RDP Protocol	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
Local browser	Netscape	No	No	Netscape	No	No	IE 4	Netscape	Netscape	Netscape	No	IE 5.5	Netscape
SmartCard reader	No	No	Yes	Optional	Optional	Optional	Optional	Optional	Optional	Optional	No	Optional	Optional
SmartCard writer	No	No	No	No	No	No	No	No	No	No	No	Optional	No
Terminal emulation	Yes	No	No	Yes	Yes	Yes	Yes	No	Yes	No	No	Yes	Optional
Height (mm)	278	51	51	93	287	287	287	287	287	287	287	287	306
Width (mm)	40	221	221	324	52	52	52	52	52	52	52	52	102
Depth (mm)	212	244	244	374	221	221	221	221	221	221	221	221	280
Weight (Kg)	2,3	2	2	7	2,5	2,5	2,5	2,5	2,5	2,5	2,5	2,5	1,8
Power (W)	36			27	15	15	15	15	15	15	15	15	Not specified
"Street price"	6 887 kr	4 722 kr	5 116 kr	6 006 kr	4 590 kr	4 940 kr	5 200 kr	7 290 kr	6 700 kr	6 200 kr	6 940 kr	8 700 kr	10 680 kr
Statskontors pris	5 924 kr	4 510 kr	4 887 kr	5 259 kr	4 330 kr	4 670 kr	4 890 kr	6 890 kr	6 330 kr	5 780 kr	6 560 kr	8 230 kr	9 612 kr
Education price	5 924 kr	4 510 kr	4 887 kr	5 259 kr	4 330 kr	4 670 kr	4 890 kr	6 890 kr	6 330 kr	5 780 kr	6 560 kr	8 230 kr	8 758 kr
Options - Browser													
Options - Term emul													
Management softw	?	?	?	443:- (1)	Free	Free	Free	Free	Free	Free	Free	Free	Free

1. The price for Fujitsus managemet software depends of the number of terminals. For example, if you are a organisation with 1000 terminals the price is 206:- / terminal
2. Wyse Rapport Workgroup Edition is free. Enterprise edition costs 250:- / terminal
3. If the terminal has PCMCIA or PCI slots for example Radio Lan
4. The Wyse prices is when byed from a WYSE VAR. To get information about the VAR:s in Sweden -please contact TeleComputing
5. The software to upgrade the terminals software is free. It's the management software to change the terminal settings that cost's.
6. This is the maximum values. On most of the terminals is'nt it possible to combine for example max resolution with max colours. Some of the terminals has also addons to get a higher resolution.

	IBM	COMPAQ		NCD		WYSE				NEOWARE		FUJITSU	ACER	ChipPC	SUN	PC		
	N2200I	T20 CE	T20 NTe	332	500	1200LE	3200LE	3230LE	8230LE	2000E	5000S	SCCOVERY xS	WT300		RAY 1	DOS	LINUX	WINDOWS
Operating system	Linux	CE	NTe	CE	CE	Wyse	CE	CE	NTe	Linux	NTe	Linux	CE	CE	Solaris	DOS 6.22	Red Hat	Win 98
Power on to con. man. (1)	- (4)	58 sec	111 sec	45 sec	62 sec	6 sec	25 sec	35 sec	75 sec	65 sec	105 sec	40 sec	18 sec	30	9 sec	28 sec	56 sec	74 sec
Warm boot to con man. (2)	- (4)	58 sec	111 sec	45 sec	62 sec	6 sec	25 sec	35 sec	75 sec	65 sec	105 sec	40 sec	18 sec	3 sec	9 sec	28 sec	56 sec	74 sec
Power on to login – ICA (3)	107 sec	63 sec	119 sec	49 sec	67 sec	8 sec	37 sec	42 sec	83 sec	74 sec	110 sec	45 sec	22 sec	32	13 sec	38 sec	62 sec	78 sec
Power on to login – RDP (3)	No support	87 sec	113 sec	47 sec	65 sec	No support	32 sec	37 sec	77 sec	69 sec	115 sec	41 sec	20 sec	33	No support	No support	No support	77 sec
PPT test	75 sec	62 sec	52 sec	71 sec	63 sec	55 sec	80 sec	65 sec	45 sec	107 sec	55 sec	61 sec	74 sec	44	44 sec	43 sec	81 sec	84 sec
Picture test	Rate 3	Rate 3	Rate 4	Rate 3	Rate 3	Rate 4	Rate 4	Rate 3	Rate 4	Rate 3	Rate 4	Rate 4	Rate 4	Rate 4	Rate 4	Rate 4	Rate 3	Rate 3
Sound test	Rate 4	Rate 4	Rate 4	Rate 4	Rate 4	Rate 4	Rate 4	Rate 4	Rate 4	Rate 4	Rate 4	Doesnt work	Doesnt work	Rate 4	Rate 4	Not tested	Not tested	Not tested
Video test	Rate 3	Rate 3	Rate 2	Rate 3	Rate 3	Rate 3	Rate 2	Rate 3	Rate 3	Rate 3	Rate 3	Rate 3	Didnt start	Rate 3	Rate 4	Rate 4	Rate 2	Rate 3
Local print test	OK	No (6)	OK	OK	OK	OK	No (6)	No (6)	OK	OK	No (5)	OK	OK	OK	NO (8)	OK	NO (8)	OK
Local com test	No	No (7)	No (7)	OK	OK	No 7	No (7)	No (7)	NO	OK	OK	OK	OK	OK	NO (8)	OK	NO (8)	OK

1. Taken the power cord out and put back until that the connection manager starts.
2. Switch the terminal off with the power button. This differs from power cord out on some terminals because they are going in to sleep mode with the switch instead of switching off
3. With setting in the terminal of automatic connect to predefined session. On NTe terminals with autlogon to the local OS.
4. IBM autostarts the ICA client directly
5. It was not enough space on the disk to install either HP DeskJet or HP LaserJet printer drivers. The test could not be done.
6. On the Wyse and Compaq CE terminals, we couldnt get the USB printing to work. With more time it almost certain that it's going the be solved.
7. On all of the USB terminals we have tried 4 different USB to Serial converters to attach to the PDA - none worked. Wyse is going to send us one that works!
8. To little knowledge of Linux and Unix to make a parallell and seriall communication to work!

*Comments:*

All NT Embedded machine has problem with the graphic. The screen gets grey in squares every now and then