

7signal Sapphire

Deployment Guide

Release 3.0

PREFACE

Document scope

This document is aimed for people that shall manage and configure 7signal Sapphire quality tests on wlan networks. These administrators may select the target networks and stabilize the expected the radio environment. The test pattern configuration and 7signal Sapphire system administration are explained in this document.

This document does not describe how the software is installed and how to handle the monitoring station. This is found in 7signal Sapphire Deployment Guide. To get guidance on how to interpret the measurements, please turn to 7signal Sapphire Loupe User Guide.

FCC Warning

The radiated output power of the 7signal Sapphire Eye complies with the FCC RF exposure limits. To avoid the possibility of exceeding the FCC radio frequency exposure limits, a distance of at least 20 cm should be kept with the user and the device while operating.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This device is restricted to indoor-only use for the 5150.0 – 5250.0 MHz band.

The FCC ID for 7signal Sapphire Eye is YLF-2010-08-APU2 for IEEE802.11a/b/g

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The FCC ID for 7signal Sapphire Eye is YLF-EYE-ABGN-APU3 for IEEE802.11a/b/g/n

Note to the user

Any uninstructed modification to the 7signal products may result in violation of FCC requirements, void warranty- Please check the 7signal Customer Terms that are delivered with the product. 7signal Sapphire Eye contains for IEEE802.11a/b/g contains FCC ID NKRDCMA82 and Eye for IEEE802.11a/b/g/n contains FCC ID TV7R52HN.

In-door use restriction by FCC

Every device operating in 5150.0 – 5250.0 MHz band has similar FCC restrictions – if applicable – as 7signal Sapphire. The regulation does not limit the value of 7signal Sapphire in any way. If the targeted wireless environment uses this band, the wireless clients as well as access points are to be used indoors like 7signal Sapphire.

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1 7SIGNAL WQA SOLUTION

Welcome to 7signal Sapphire, providing you with a new way to continuously and automatically measure the health and quality of a wireless network from the user's perspective. A commonly used term here is wireless quality assurance, or WQA. Companies and their business processes are becoming increasingly dependent on the performance and service quality of their wireless networks. Thanks to the Sapphire WQA solution, companies can integrate the quality management of wireless networks with their existing IT and communications technology services.

7signal Sapphire uses monitoring stations (Sapphire Eye) to monitor performance and quality in WLAN cells and to monitor the surrounding radio frequency environment. The performance of the customer's network is tested against a test server (Sonar). Interactive tests, monitoring stations, and parameters for automatic measurement are managed with a centralized management tool (Sapphire Carat). The measurement results are reported via a business application (Sapphire Loupe). Both tools can forward results either automatically or manually to designated persons in the company, or to third parties, such as technical support or other service provider.

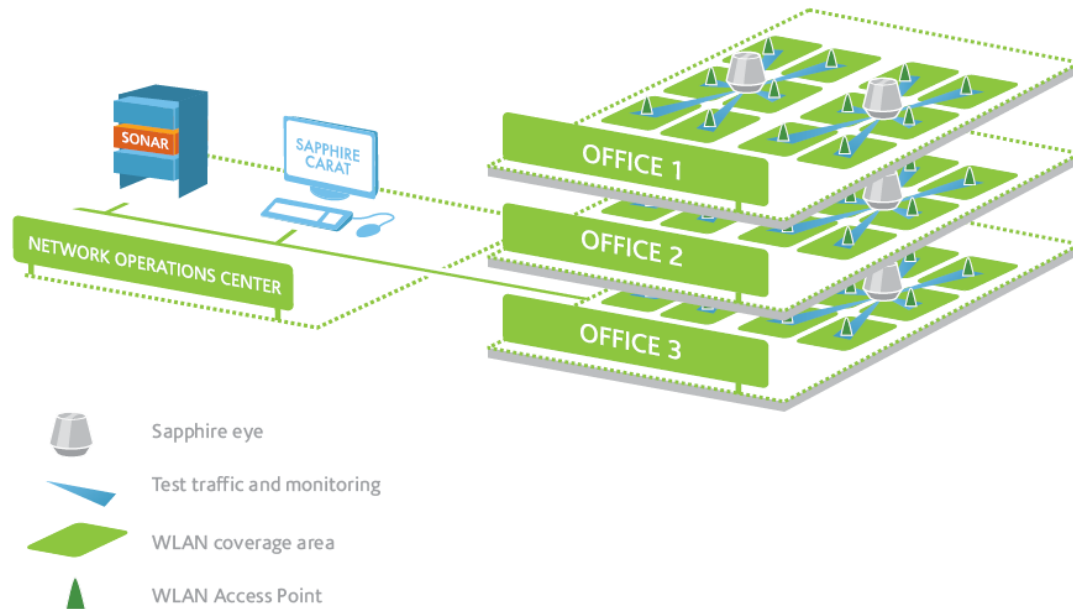
The monitoring station, Sapphire Eye, continuously monitors the selected WLAN channels via passive listening, which does not have an impact on network performance. It can also impersonate a client device in the target network and then use the network and the services provided through it. By comparing measurement results to a previously saved acceptable environment, the solution can detect interfering transmitters, access points and clients behaving in undesirable ways, and other applications using unregulated frequency bands that can potentially affect network functionality. Among these applications might be motion detectors, microwave ovens, Bluetooth devices, powerful electric motors, radiation devices used for decontamination, and baby monitors. The solution can also produce proactive statistics on the predicted user experience of network performance, which enables the company to increase network capacity before the users notice loss of performance.

In user emulation tests, also known as active tests, Eye connects to the test server (Sonar) over the wireless network and uses it like an ordinary production service. The use may include mass file transfers, browser downloads, wireless VoIP calls, or connections to another production server. Simply put, Sapphire tests the end-user experience by examining the entire data chain from the client to the production service. Active tests can monitor the network even when there are no users in the network. This makes it possible to forecast performance problems and to take corrective actions even before the service level suffers. Active tests show the availability and quality of services offered over the network, and they help administrators to see why some applications with their various demands for network performance do not work as expected in the network or some of its areas. When problems occur, active tests can also aid in location of the problem area in the network topology, which often includes WLAN, LAN, and WAN elements.

The key benefits of 7signal Sapphire are user emulation, superb coverage, continuous monitoring, and visibility of network health. Competing solutions are often based on monitoring the access point settings. As a result, they do not give any indication of the service quality experienced by the end user. In such limited solutions, the service quality parameters measured are the same as in wired networks. Sapphire, by contrast, produces a comprehensive picture of the radio connection quality, where delay, number of retransmissions, and packet loss are taken into account, in addition to the commonly measured parameters.

1.1 Solution Overview

The 7signal Sapphire quality monitoring solution consists of a Sapphire Eye monitoring station, a Sonar test server, the feature-rich Sapphire Carat management software, and Sapphire Loupe for viewing and reporting on results.



1.2 Solution versions

7signal Sapphire Suite is the name given to a system that monitors the quality of a wireless broadband network as described in the [Solution overview](#) section, above.

7signal Sapphire contains the central components needed for a broadband network's quality monitoring. The tests include interactive troubleshooting tests and automatic collection of measurements. Loupe can be used for generating case-specific reports or for sending automatic reports to selected recipients.

7signal Sapphire Enterprise contains features needed in business and corporate networks, such as quality monitoring for wireless VoIP calls, monitoring of the service classes of wireless traffic, and extended monitoring features for channel behavior.

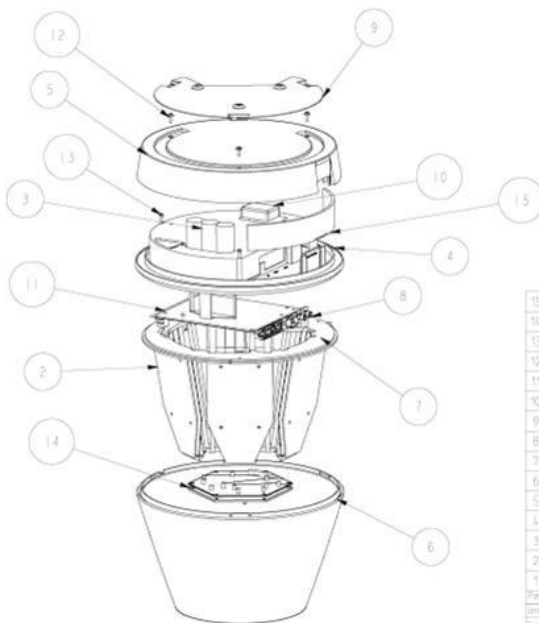
1.3 Hardware

7signal Sapphire Eye is a wireless probe or a monitoring station that is installed in a central position within the wlan network.

Eye has the following main features (partly optional):

- Mechanical parts injection moulded polycarbonate plastic;
- Linux computer, 1GB Flash memory;
- Wlan radio module, 802.11 a/b/g support (2.4 GHz, 4.9 GHz-5.8 GHz);
- Spectrum Analyser component;

- 6 sectored high gain antennas covering 360 degrees in horizontal direction, 1 sectored high gain antenna in vertical direction;
- RF board with antenna beam selection capability and low noise amplifiers (noise figure ~1.5 dB) in receiver chain;
- Battery;
- Heating element;
- Other functional elements;
- Electrical compass;
- GPS receiver;
 - GPS receiver may be augmented with an external antenna that is not provided by 7signal;



15	-	Seal	190.5x28x3	CR	-	1
14	-	RF PCB	-	-	-	1
13	-	Plastofast 1442	2.5x7	-	-	3
12	-	Plastofast 1441	2.5x7	-	-	3
11	-	Main PCB	-	-	-	1
10	-	GPS Antenna	-	ML-75	-	1
9	-	Fixing Plate	-	ZINC-ELECTROPLATED	-	1
8	-	Ext. Antenna Connector	-	SMA	-	1
7	-	Cover D	-	PC	-	1
6	-	Cover C	-	PC	-	1
5	-	Cover B	-	PC	-	1
4	-	Cover A	-	PC	-	1
3	-	Battery Rack	-	-	-	1
2	-	Antenna PCB	-	-	-	6
1	-	-	-	-	-	5
Part Drawing no. Part description. Shape, notes. Amount. Quality. Properties. Qty.						
Part treatment. Color.						
Appr.		Product		Name		
Design		1.14		10033541.9 kg		Note: no

2 REQUIREMENTS

2.1 Carat-server requirements

Carat server controls Eye units and collects measurement results to the database. Carat server software can be installed to dedicated server or virtual environment.

The operating system is CentOS that is community version of Red Hat, the only difference are in graphics and similar items. Carat server has management connection to the Eye units and it can manage concurrently several Eyes in several locations.

The Carat server requirements are below:

- x86 32-bit Intel and AMD processors
- minimum 2 GB RAM
- installation minimum 10GB Hard Disk Space required
- database space: depending on target network size, (for reference, typical data volume = uncompressed raw measurement data /AP/month = circa 50MB)
- LAN connection
- CentOS 5.4

2.2 Sonar-server requirements

Sonar is a light end-point software for Sapphire active tests. Sonar server software can be installed to dedicated server or virtual environment.

Eye will connect to the Sonar and run application tests towards it. Sonars can be installed into several locations in the network to simulate the real-life situation where various business services are geographically distributed.

The Sonar server requirements are below:

- x86 32-bit Intel and AMD processors
- LAN connection
- CentOS 5.4

There are no specific RAM or disk requirements as Sonar is truly a light-weight server software.

To best reflect the business-application behavior, Sonar server would benefit from similar characteristics than the server running the business application. For example, the Windows TCP/IP stack implementation may limit performance by default.

3 WLAN AUTHENTICATION AND ENCRYPTION

7signal Sapphire solution supports several standard encryption and authentication methods for accessing wlan radio resources.

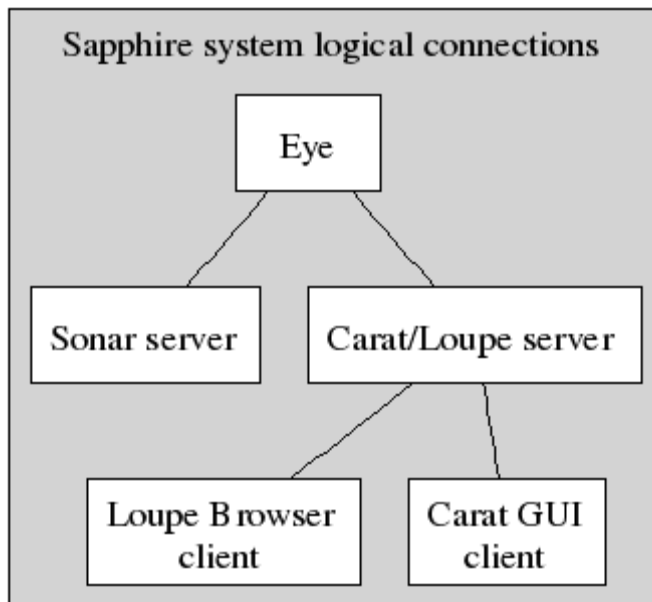
The Supported methods are in the table below:

WPA 1/2	PSK EAP - TLS EAP - PEAP EAP - FAST EAP - TTLS	
	EAP - TTLS	MSCHAP MSCHAPV2 PAP CHAP EAP - MSCHAPv2 EAP - TLS EAP - GTC EAP - OTP EAP - MD5
IEEE 802.1X	EAP-TLS	
	EAP-PEAP	GTC MD5 MSCHAPV2 OTP TLS
WEP	40 128	
LEAP with WPA1/WPA2		

4 7SIGNAL SAPPHIRE CONNECTIVITY

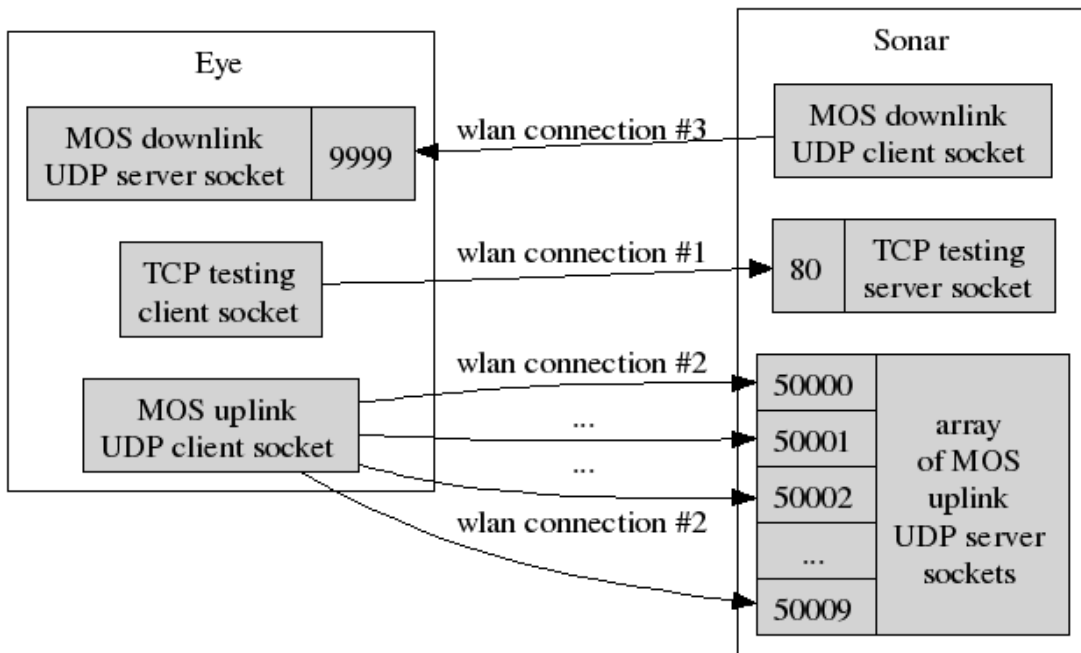
4.1 Logical connections

Sapphire elements and their logical connections are in the picture below:



- **Eye** – a wlan probe with both wlan interface (wlan client and analysis functions) and ethernet interface (management functions).
- **Sonar** – Server software emulating various business services for testing purposes. Deployment method is two-fold as follows: 7signal Solution: the application is running in hosts chosen by the customer. 7signal Site Miner: a dedicated mini-laptop is running the application.
- **Carat** – centralized management software, a stand-alone application. Deployment method is two-fold as follows: 7signal Solution: the application running in a host chosen by the customer. 7signal Site Miner: a dedicated normal laptop running the application.
- **Loupe** – A web-application for measurement visualization that is deployed in conjunction of the Carat server software.
- **Internet browsers** – Thin-clients for Loupe server. Not provided by 7signal.

4.1.1 Eye – Sonar connection



Conn ID	Description	Data content	Listening port(s)	Remarks
1	Test management and typical test connection	Test control message and pseudo-data	tcp/80 Configurable in Sonar deployment	Traffic is properly encapsulated http. Uses Eye wlan interface.
2	MOS test, uplink direction	MOS test specific data	udp/50000 – 50009 Configurable in Sonar installer	Optional. Uses Eye wlan interface. The number of port varies between 0 and 20. The port numbers are consecutive. By default 10 ports are opened.
3	MOS test, downlink direction	MOS test specific data	udp/9999 Configurable in Eye deployment	Optional. Uses Eye wlan interface.

Main purpose: Eye connects through wlan interface to the remote server that simulates or emulates business applications.

Important notice: this is most likely the most complex connection in 7signal Sapphire systems. The Sonar servers may be numerous and the network topology between Eye and Sonar may vary radically and could contain numerous firewalls. 7signal has no control over the network topology and cannot influence arbitrary devices and network elements between the endpoints. To ensure fluent deployment, the user/configurator has to have thorough understanding of the network between the endpoints and possibility to affect all the elements necessary.

To test and use the wireless connection the following variables must be known:

- ESSID – test parameter to connect to a particular wireless network.
- Wlan encryption – The encryption is “Wireless Network” related configuration in Carat.

Network keys – pre-shared keys, certificates or similar - are stored in Eye file system by Carat application.

To be observed: the target wireless network may be configured to have MAC address preventions so the MAC address of wlan interface of the Eye unit must be white-listed as a network client. Eye does not act as an access point of the wireless network.

Security: while the connection is established, the test parameters and results go unencrypted over 7signal proprietary protocol encapsulated in well-formed http between the endpoints. It is difficult to imagine that the test parameters and pseudo-data would pose any business risk to customers. Furthermore, by default there is no encryption in the IP traffic of the wireless clients so in this sense the current state reflects the real-world well.

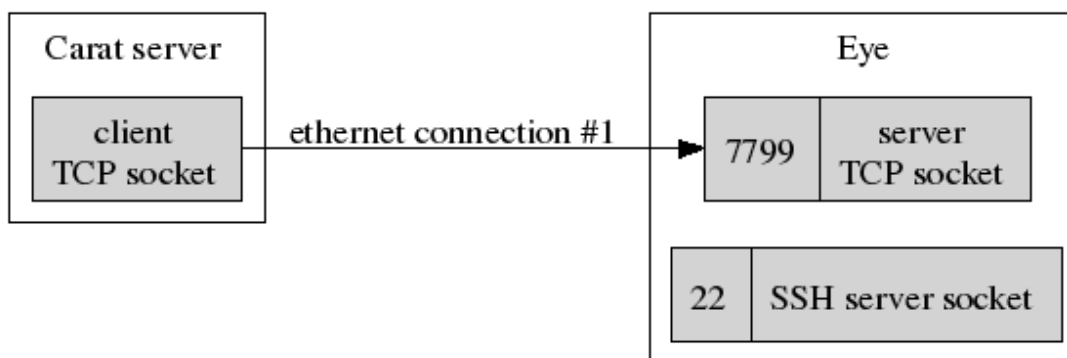
MOS test connections

MOS test is a license-controlled feature and not used in every environment. MOS test requires additional ports to be used. MOS traffic is special-purpose traffic with identical fingerprint than any VoWLAN call would have.

Sonar may serve numerous Eyes concurrently and therefore provides numerous open server socket s for incoming VoIP calls. One server socket may serve one Eye at a time so the number of concurrent MOS tests in single Sonar is dictated by the number of open ports.

Eye has one open server socket for VoIP calls as it communicates with single Sonar only at a time.

4.1.2 Eye – Carat connection

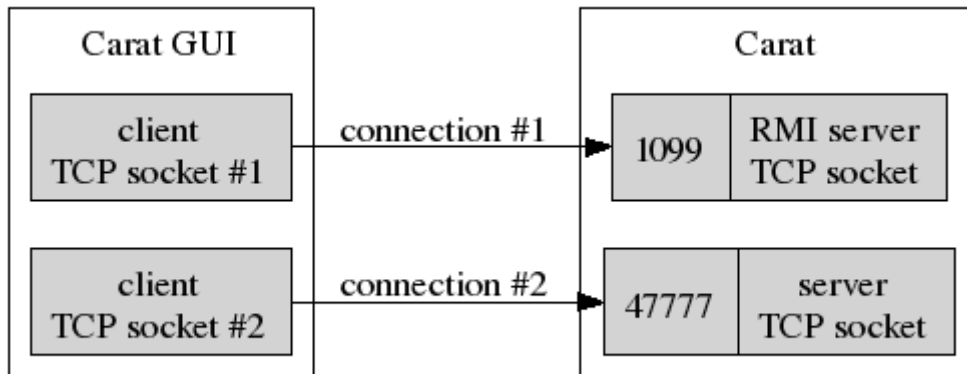


Conn ID	Description	Data content	Listening port(s)	Remarks
1	Eye test server	Binary protocol for management	tcp/7799	Uses Eye ethernet interface.

		and testing.	Configurable in Eye deployment	
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In this case the Eye acts as a server and Carat software is a client. Carat does not make any ssh connections, ssh is optional connection for human operators.

4.1.3 Carat server – Carat GUI connection

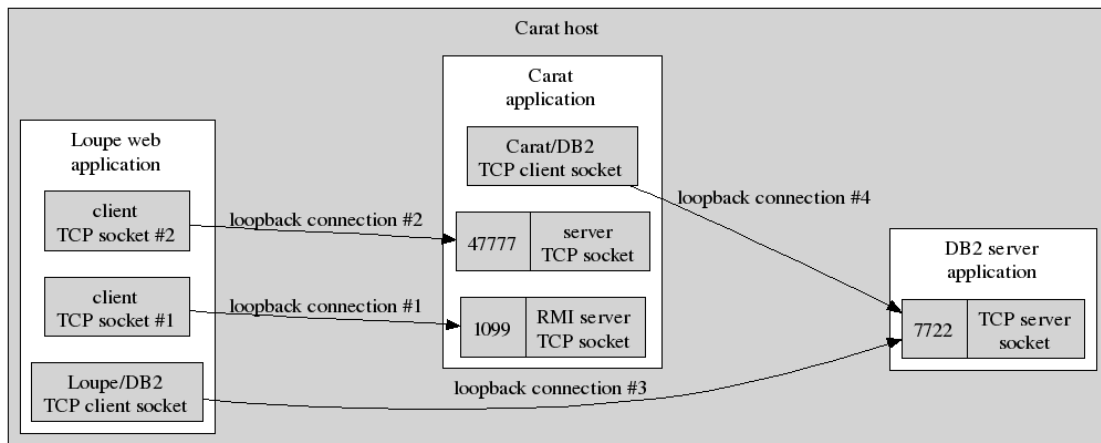


Conn ID	Description	Data content	Listening port(s)	Remarks
1	RMI service	RMI service protocol	tcp/1099	Discovery service for conn #2.
			Typically not changed.	
2	GUI client connection to a Carat server	RMI calls	tcp/47777	
			Configurable in Carat GUI installer	

The Carat graphical user-interface is a stand-alone Java SE application that is a client to Carat server. It is for managerial actions and interactive wlan network testing for human operators.

4.1.4 Internal connections in Carat server

Note: as the following connections occur inside one host machine only, this part may be skipped regarding the firewall settings and other networking.



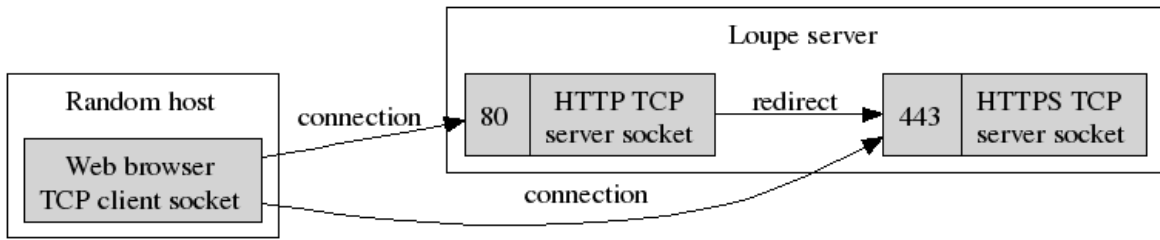
Conn ID	Description	Data content	Listening port(s)	Remarks
1	RMI service.	RMI service protocol	tcp/1099	Discovery service for conn #2.
			Typically not changed.	
2	Loupe web-app connecting as a client to a Carat server.	RMI calls	tcp/47777	
			Configurable in Carat GUI installer	
3	IBM DB2 database service for Loupe.	JDBC traffic.	tcp/7722	
			Configurable in DBMS installer	
4	IBM DB2 database service for Carat.	JDBC traffic.	tcp/7722	
			Configurable in DBMS installer	

Loupe is a web-application that visualizes the measurements and it has a dual-role in the sense of connectivity: Loupe acts as a client to both the Carat server and DB2 and as a server to the browser clients. The actual rendering of Sapphire results happens in browsers (separate chapter below). In the current implementation Carat and Loupe applications are inseparable as they run in the same host in all supported setups.

In the current implementation Carat and IBM DB2 applications are inseparable as they run in the same host in all supported setups. The connection between Carat client and DB2 is secured by medium-level encryption implemented by IBM.

7signal installers contain the installation medium for DB2 and the setup of DB2 is automated by 7signal installation scripts. It is possible to change the defaults during installation time.

4.1.5 Loupe – internet browser connection



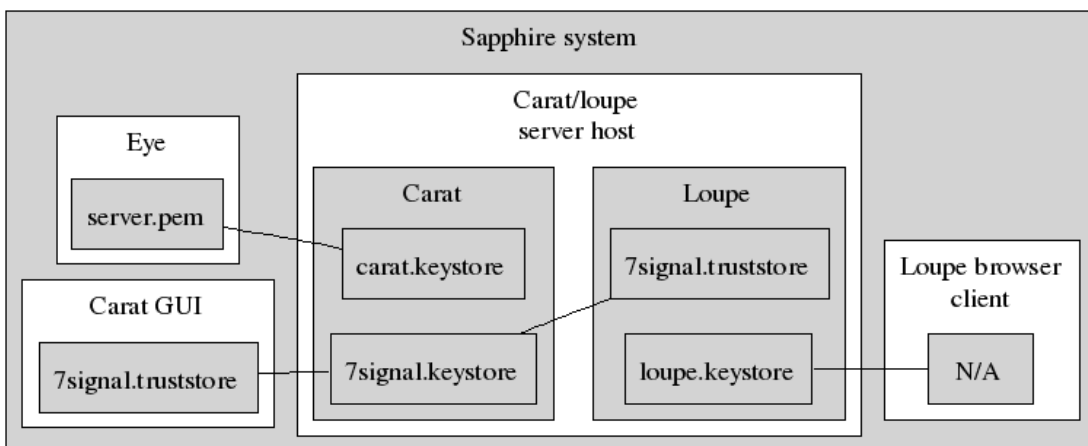
Conn ID	Description	Data content	Listening port(s)	Remarks
1	Standard http connection.	Standard http traffic for creating a https connection.	tcp/80	Redirects to https port of Loupe.
			Configurable in Loupe installer.	
2	Standard https connection for measurement requests and responses.	Secure http. Report and chart requests and responses.	tcp/443	Business connection for Loupe.
			Configurable in Loupe installer.	

Carat server contains a web application named Loupe that runs on port that is defined during Loupe server installation, the default is 80. Browser user sets the URI to access Loupe server, the URI depends on Loupe server configuration. Loupe server communication is secured with a server certificate. No certificate is needed from the user / browser side.

4.2 Communication security

All connections containing meaningful traffic are being encrypted. The encryption method is TLS on top of TCP or UDP on top of IP. The PKI infrastructure (certificates) is being used throughout the solution but the files differ as there are has numerous formats for certificate containers while the contents are according the same method.

Encrypted connections are depicted below:



- **Eye - Carat**
Eye server certificate and CA signature are in file called server.pem. The client counterpart is stored in the Carat server in file carat.keystore (while effectively it is a truststore).
- **Carat – Carat GUI and Carat - Loupe**
The server certificate resides in file called 7signal.keystore. The client counterpart resides in file named 7signal.truststore. Loupe resides in the same host and most probably in the same file system than Carat itself. In case of GUI the file is any computer that has GUI installed.
- **Loupe – browser**
The web-app identifies itself with a file named loupe.keystore. The counterpart is not provided by 7signal but because of commonplace browser infrastructure it is not necessary.

Usage of encryption files

Every customer has individual set of certificates, it is not possible to use the delivered certificates to decrypt traffic of other 7signal Sapphire systems.

Q: Where can I find my certificates? A: All the customer certificates are located in the certificates CD and certificate passwords in password sheet.

It is neither necessary nor encouraged to handle the certificate container files. Install and upgrade processes of 7signal Sapphire take care of all the typical cases. In untypical cases the 7signal staff shall be involved with all the help necessary.

4.3 Supportive connections

4.3.1 SSH for Eye

In the normal course of operation no ssh connection is required. However, during complex deployments the analysis opportunities in Eye shall justify such a connection. Also, Eye firmware and certificates may be managed with ssh. The ssh traffic is inherently secure.

4.4 Bandwith requirements

NOTE: the volume estimates are suggestive and vary based on the configuration.

4.4.1 Eye – Sonar

From	To	Medium	Traffic motivator	Volume estimate	Major factor
Eye	Sonar	Wlan	Automated test engine and interactive testing by	Low, each request is a few hundred bytes. Eye acts as one	The test profile that the Eye is running. In case of MOS test VoFi traffic is transmitted as long

			humans.	wlan end-user would do, one operation per minute.	as requested in the test parameters, constant traffic at the rate of 100 kB/s.
Sonar	Eye	Wlan	Responses to client.	Typically pseudo-data that varies based on the test parameters.	MOS test most probably contain significant amount of data.

For example, the FTP download test transfers by default 2 megabytes of data that does not take long. The amount of data is exceptionally high for data transfer in an logistics environment but on the other hand in office environment transfer of this size is relatively low. The test parameter should be adjusted, either to simulate typical transfer or to save the bandwidth while keeping the transfer size high enough to give measurements out of the network.

4.4.2 Eye – Carat

From	To	Medium	Traffic motivator	Volume estimate	Major factor
Carat	Eye	Ethernet	Automated test engine and interactive testing by humans.	1 kB/minute. The binary protocol for requests is volume-efficient.	The chosen test profile and individual test parameters dictate whether the Eye keeps testing a long time or is there frequent test management traffic. Duration of one test varies from a few seconds to almost minutes per request depending on the test type.
Eye	Carat	Ethernet	Responses to client.	100 kB /minute.	Spectrum Analysis and MOS test most probably contain significant amount of data.

The data transferred in only test parameters and in most cases results of analysis, sometimes raw measurements.

Naturally the number of Eyes is directionally proportional the traffic load as each Eye connection are independent and concurrent. One single Eye typically executes a test in one minute in the average. However, there are tests that finish in 10 seconds (practical minimum) and few tests run few minutes.

The communication protocol is both minimal and binary so the traffic from Carat to Eye is very economic. The measurement result minimum is around 100 bytes in one message and the top range is the spectrum measurement (not available in all configurations) that returns approximately 300 times a 50 byte result unit.

In data communications sense the traffic for single Eye is minimal.

Test type and test distribution depend on the test profile used in the Carat server. The test profile content and test parameters (incl. test duration and size of file transfers) are freely modifiable by Carat system administrator.

4.4.3 Carat server – Carat GUI client

From	To	Medium	Traffic motivator	Volume estimate	Major factor
Carat	GUI	Ethernet	Human	Very low.	User activity, expected low.
GUI	Carat	Ethernet	Responses to client.	300 kB/minute	Spectrum Analysis and MOS test results may contain significant amount of data. Floorplan involves graphics.

There is no continuous interaction, all activities are initiated by the user. The amount of traffic depends completely on user-decisions. Typically the traffic is binary communication. A few interactive tests the results are graphical.

In 7signal Solution the IP cloud between the client and the server may be complex and contain VPNs, wireless links etc. that affect the communications.

4.4.4 Loupe server – Loupe client (browser)

From	To	Medium	Traffic motivator	Volume estimate	Major factor
Loupe host	Clients in WWW	Ethernet, general networking	Human actions	Volatile. Like one http client.	User activity. Per any request the amount of requested KPIs is the driving factor.

There is no continuous machine-to-machine interaction, all activities are initiated by the user. The amount of traffic depends completely on user-decisions. Server output typically contains graphics. Medium duty cycle.

4.4.5 DB2 and Loupe server, DB2 and Carat server

In current implementation all three processes are running in the same host so there is no network burden whatsoever outside the host.

From	To	Medium	Traffic motivator	Volume estimate	Major factor
localhost	localhost	IP stack	Interoperable server processes.	N/A	The amount of Eyes in the network. Data is transferred in the core memory of the host.

5 INSTALLING 7SIGNAL SAPPHIRE

5.1 Eye setup

Every Eye unit is identical when purchased, like other wireless network elements like typical access points. Individual settings must be made to enable operation of numerous Eye units in the same production network.

By default Eye units have IP address 192.168.0.1 with netmask 255.255.255.0.

Ssh connectivity is provided for configuration purposes. Carat user-interface manages the software in the Eye but the requirement is a working management connection between Carat application and Eye appliance.

- server.pem
- IP address
- (optional) Eye software version

Connect to address 192.168.0.1 as root by using a ssh client. The root default password is '7signal'. It is strongly advised to change this password as it is factory default for every single Eye unit. One will enter a shell called ash.

Setting IP address of the management interface:

```
# 7config ip set addr <IP address>
```

Setting network mask of the management interface:

```
# 7config ip set mask <dot-format-mask>
```

Setting port of the management interface:

```
# 7config ip set port <port>
```

Create backup from current IP configuration:

```
# 7config ip backup create
```

Verify the settings with the 'show' command:

```
# 7config ip show
```

Reboot the Eye unit to make the changes effective:

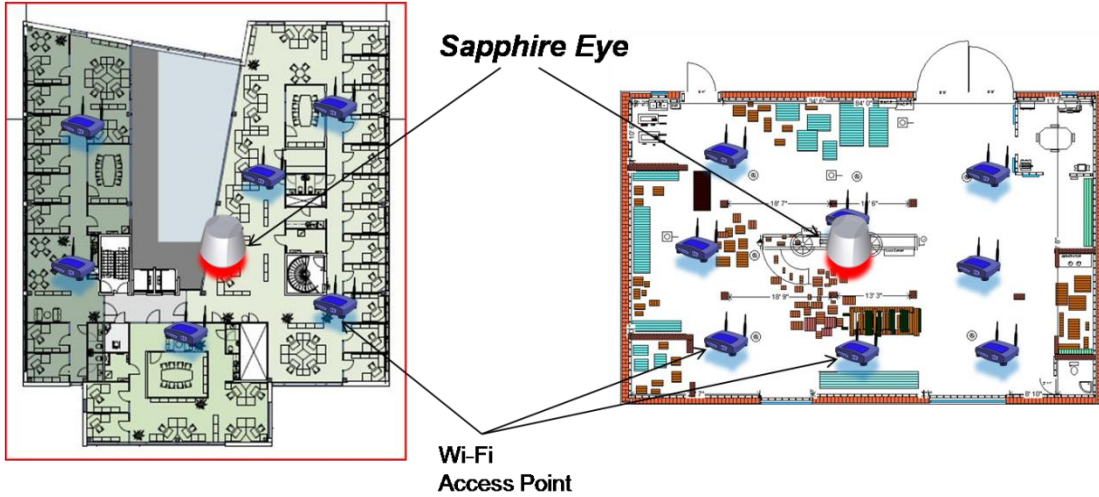
```
# reboot
```

NOTE: the unit may be unreachable in the network that is being used for the configuration if the destination network has incompatible settings.

6 INSTALLING EYE

Install Sapphire Eye in the most centralized location of the Wlan area.

Eye can be installed on the ceiling, wall or mast.



Sapphire Eye has extremely sensitive radio technology inside

- The receiving signal is 10-20dB stronger than the basic Wlan end-user
- The transmitted signal is 5-6dB stronger at the access point side than with the basic Wlan end-user

For best accuracy of the Wlan performance, the Sapphire Eye location should be selected so that:

- The average signal level for the managed Wlan access points are between -65dBm and -30dBm

NOTE: The bad performance area is not necessarily the best Eye location.

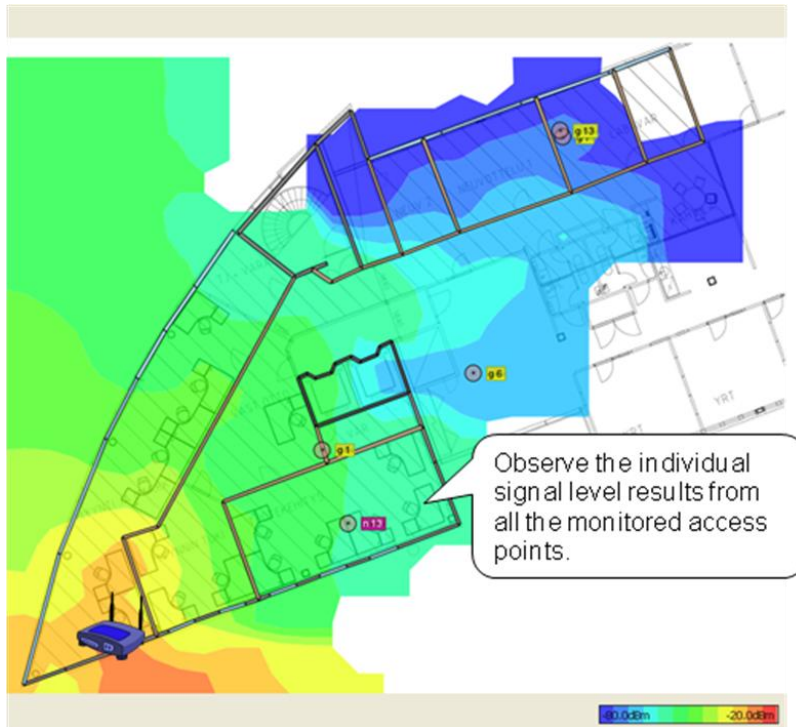
The best installation location is easily verified with:

- Portable Sapphire kit. The kit includes a Carat laptop and an Eye unit (with battery).
- Site Survey signal level results

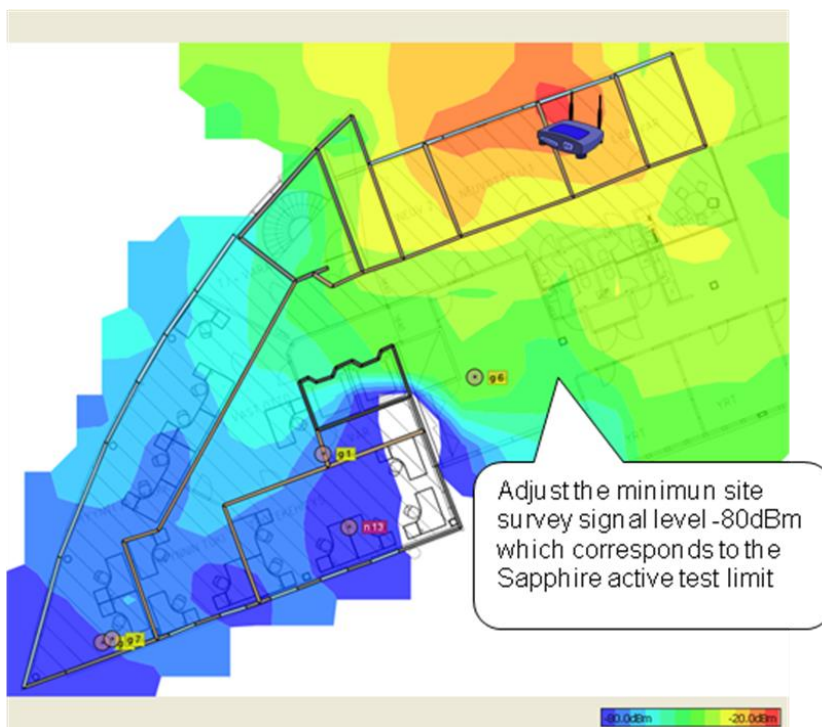


6.1 Eye installation examples

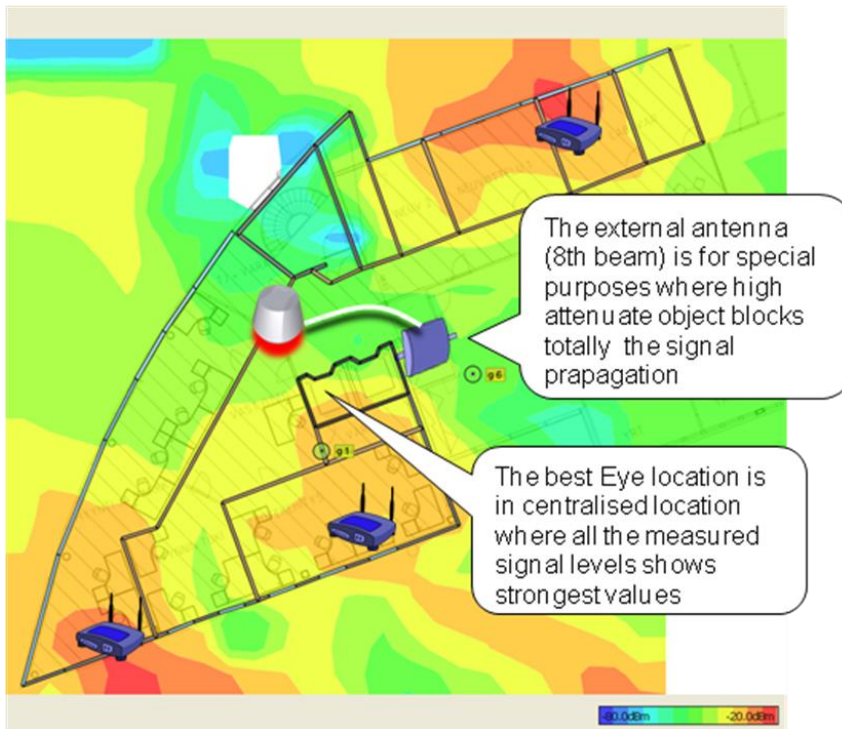
The Site Survey results are valuable for Eye location estimation. The Eye location is good if the Site Survey heat map shows $>-80\text{dBm}$ signal level from all the access points.



The Site Survey results are valuable for Eye location selection



Verify the signal levels also from the far end access points

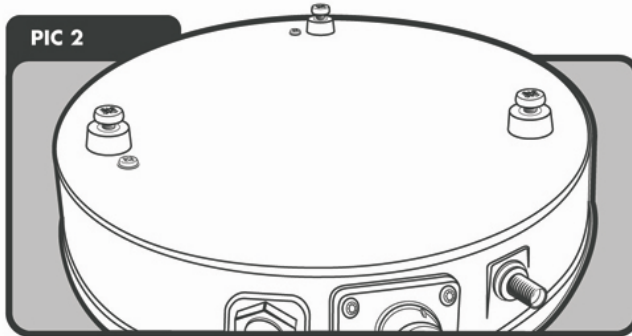


The external antenna is useful in the environment where shafts or thick walls are attenuating radio too much.

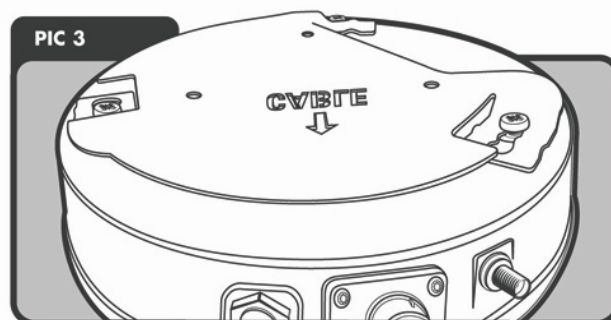
7 PHYSICAL INSTALL OF 7SIGNAL SAPPHIRE EYE

7.1 Roof Install

On top of Eye unit there are three slots for screws. Insert screws (Pan Head Stainless Screw, DIN 7985 M5x12) on top of the Eye unit. For securing the screw use screwdriver on the bottom of the screw. The head of the screw is supposed to have few millimeters of space between the inserts on the unit top.



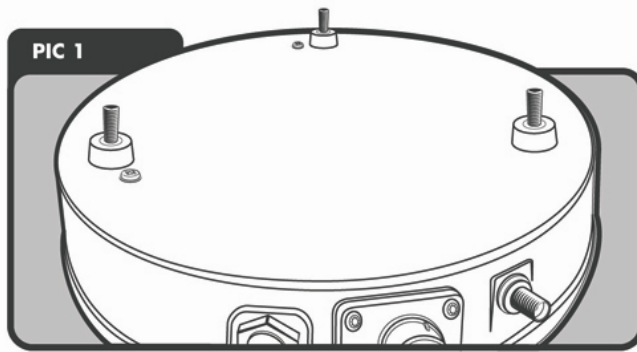
There shall be one install plate (pictured right below) that is mounted on roof. See the marking 'CABLE' on the plate and direct it as desired.



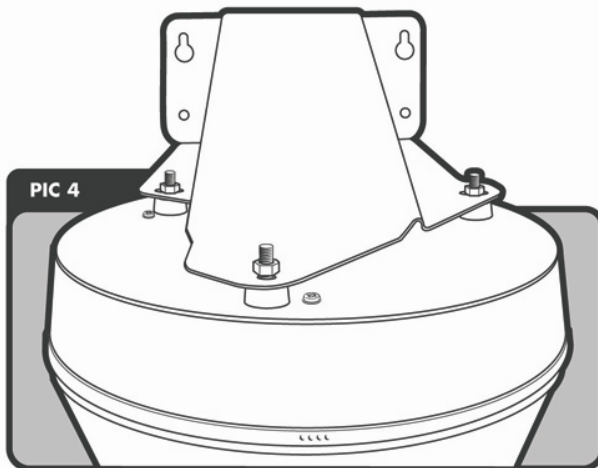
Insert the screws into the holes in the roof mounting plate. Turn the unit and feel it snatching into the plate. The unit should not be moving in a loose manner but it moves only few millimeters when properly mounted.

7.2 Wall Install

On top of Eye unit there are three slots for screws. Insert screw thread taps (Socket Set Screw Cone Point, DIN 914, M5x20) on top of the Eye unit. For securing the screw use hex key on the bottom of the screw. In wall-mounting the screw does not have any head.



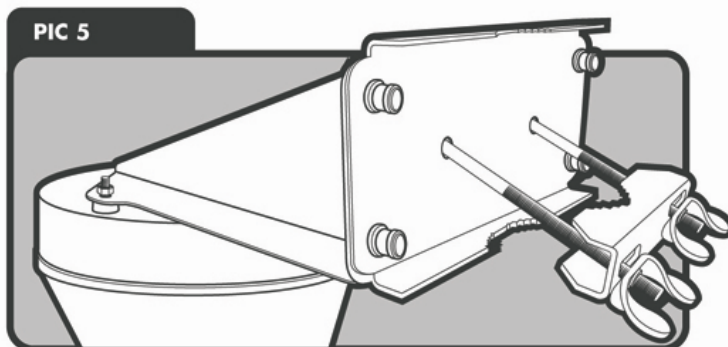
There shall be one install mechanics (pictured right below). Mount it on the wall on the rectangular side. The longest side of the triangle should face towards the ground.



There are three elliptical holes in the wall-mount mechanics. Mount the Eye unit by pushing the screws on top of the unit through the wall-mount mechanics. From the top-side of the mechanics use the screws to attach the unit to the mechanics.

7.3 Pole Install

In pole install the wall-mount is attached to any pole by using mechanics (A and B, picture below). Screw the part B on hook A in order to attach the wall-mount to the pole. Follow the wall-mount instructions from here on.



8 INSTALLING 7SIGNAL SAPPHIRE SOFTWARE

Install the following software from the 7signal Sapphire Installation CD.

8.1 Carat DBMS (Linux)

Prerequisites

The operating system installation may or may not have all the necessary information for DBMS installation. Please check the following items:

- C++ library
 - command: `yum install compat-libstdc++-33`
 - An RPM package is contained in Sonar medium in folder named 'Non-7signal Software' in case there is no network connectivity
- Hosts file must contain the localhost name.
 - `more /etc/hosts`
 - edit the hosts file if needed

Installing

The DBMS for Linux comes as a file of type bin that contains both the script and 3rd party install package for DBMS. There is another version of the DBMS installer that does not contain the actual DBMS package. The latter is suitable for upgrades. The install may be run in any directory, the root home is just a practical example.

Copy 7signal-DBMS-installer from delivery medium to for example `/root` directory. NOTE! Do not use `/tmp` directory.

Step 1 (option 1): Install DBMS database uninterrupted with the default settings by issuing a command:

```
# ./7signal-DBMS-x.x-x.x-installer.bin -s
```

The silent install does not require input as all the options shall use default settings. Since release 2.0 the DBMS install is instructed to be the first element to install. The silent install suits this model well but it is up to the user if one wants to install Carat server first: both ways work fine.

Step 1 (option 2): Install DBMS database by issuing a command:

```
# ./7signal-DBMS-x.x-x.x-installer.bin <path_to_DB2_package>
```

The DB2 package is in delivery medium for Sonar in folder named 'Non-7signal Software'. 7signal is the official distributor for IBM DB2.

To understand the phases of the installation, install output is below.

```
Extracting installer, please wait ...
```

```

Launching installer.
Using db2exc_950_LNX_x86.tar.gz installer.
Checking host janice reachability.. OK.
Trying to locate existing installation...
Locating 7signal Sapphire Carat installation. Please wait ...
Carat installation found at /opt/7signal/Carat.
DB tools directory will be /opt/7signal/dbms
Do you want to use DB configuration found from this location [Y/n]?
<enter>

```

The question above is asked if there is an effective 7signal Carat install on the host. Since release 2.0 this question should not be there on initial install as the DBMS is encouraged to be installed first.

The script continues:

```

DBMS directory           : /opt/7signal/dbms
DB2 installation package location : installer/db2exc_950_LNX_x86.tar.gz
Target directory        : /opt/ibm/db2

```

```

untarring DB2...
Creating DB user..
Configured DB user is db7sign
Configured DB port number is 7722

```

Do you want to specify DB admin manually [y/N]? <enter>

The script allows to defined the database user and the communication port. As supposedly the host is dedicated to 7signal Sapphire, the defaults should work fine and are encouraged to be used.

The script continues and executes some time consuming configurations:

```

Preparing response file...
Running response file...
DBI1191I db2setup is installing and configuring DB2 according to the
        response file provided. Please wait.
The execution completed successfully.

```

```

For more information see the DB2 installation log at
"/tmp/db2setup.log".
IBM DB2 installed.
Creating uninstaller...
Creating DB schema generator...
Copying aggregation view template generator and templates to
/home/db7sign/.
Installing 7db tool..
Installing 7signal DB backup & restore tool..
Installing 7signal DB2 library..
Installing 7signal DB2 utilities..
Enter location for databases [/home/db7sign]: <enter>

```

The database tablespace location defaults to the /home file system just like the database logs that are configured below.

This default setup should not be used in a serious production environment but the logs and the actual database should reside in separate file systems, preferably on separate physical devices. Any database write shall be recorded both to the logs and the actual database table space thus doubling the write operations and space demand for the same device and file system. High-end disk array storage devices may not suffer from this but as a rule-of-thumb it is always a good idea to separate logs and the actual database.

The script continues:

```
Do you want to create databases now [Y/n]? <enter>
```

The script allows the databases not to be created. It is not supported to not to create the databases and the use of this option is recommended only for people who already know how to recreate the databases later.

The script continues and the database creation takes several minutes:

```
7SIGNAL creating management database...
```

```
7SIGNAL creating measurement database...
```

```
7SIGNAL creating security database...
```

```
Do you want to change the default database logging method (circular logging) to infinite archival logging [y/N]? <enter>
```

It is encouraged to make the install with circular logging. The infinite archival logging requires design and practically endless storage device. The instructions for moving to infinite archival logging are in the Carat User Manual among other detailed backup process design issues.

The script continues to...

Log file location

Log file location default to the `/home` file system just like the actual database.

This default setup should not be used in a serious production environment but the logs and the actual database should reside in separate file systems, preferably on separate physical devices. Any database write shall be recorded both to the logs and the actual database table space thus doubling the write operations and space demand for the same device and file system. High-end disk array storage devices may not suffer from this but as a rule-of-thumb it is always a good idea to separate logs and the actual database.

```
Enter location for Management DB log files  
[/home/db7sign/db7sign/NODE0000/SQL00001/SQLLOGDIR/]: <enter>
```

```
OK. Using default.  
Enter location for Measurement DB log files  
[/home/db7sign/db7sign/NODE0000/SQL00002/SQLLOGDIR/]: <enter>
```

```
OK. Using default.
```

```
Enter location for Security DB log files
[/home/db7sign/db7sign/NODE0000/SQL00003/SQLLOGDIR/]: <enter>
OK. Using default.
```

The script is now finished. The DB2 is now installed, up and running. One may continue to install next component.

8.2 Carat server (Linux)

Copy the installer file from the delivery medium to for example `/home` directory.

NOTE! Do not use `/tmp` directory.

Step 1: Move to the directory where installer was copied and install Carat server by issuing a command:

```
# ./7signal-Carat-x.x-x.x-installer.bin
```

You should see output similar to following:

```
Extracting installer, please wait ...
Launching installer.
Checking previous installations...
Installations were not found
Enter location to which 7signal Sapphire Carat server will be installed
[/opt/7signal]: <enter>
Trying to locate 7signal DBMS installation. Please wait ...
DBMS installation was not found. Do you want to specify DB properties
manually
(defaults: database host localhost, username 'db7sign', TCP port 7722)
[y/N]? <enter>
```

Step 2: defined the database essential parameters:

In case one does not use the defaults, one must give

- host IP address
- username for the database access user
- and the port for the database communication

As this connection is inside one single host and completely internal to 7signal Sapphire, it is recommended to use the defaults.

The script continues:

```
Please enter host name or IP address to which the Carat clients will be
connecting to [192.168.0.2]: <enter>
```

Step 3: setup host address for RMI server

One should not use localhost or 127.0.0.1 for the IP address as this information shall be used by RMI server and it needs to know the external IP address of the host in numeric format in order to serve the remotely connecting clients.

The script continues:

```
Encryption certificates from certificate package [Y/n]? <enter>
```

Step 4: Install certificate container and its password

The above mentioned package is not part of the standard delivery. The GUI certificate container and related password are in separate delivery medium in where the folder naming pinpoints the right location for this information. If the certificate and password are copied to the target machine, it is better to remove them after install verification unless one trusts the file system security enough.

The script continues:

```
Please enter location of archive file (<prefix>-7signal-all.tar.gz):  
Found file /root/7signal_storet-7signal-all.tar.gz. Do wish to use it  
[Y/n]? <enter>
```

This option reflects how the user interaction looks like when certificate package install is being used. In case of non-package install the script asks for path to the certificate container and the password.

The script continues:

```
Validating archive..  
Archive valid.  
Extracting files..  
Extracting passwords..  
Please enter location of Carat license file (directory in which  
license.xml file resides): <path>
```

Step 5: The license file location

The license file is created for each customer individually. It is in the same delivery medium with the certificate containers. The file is digitally signed and does not require as high security as the certificates.

```
Creating carat7 user...  
Copying init script..  
Installing init script..  
Extracting Carat package...  
Copying Carat to /opt/7signal...  
Extracting jre...  
JRE already installed, checking if it is up to date  
Installed version: 1.6.0_06-b02  
New version      : 1.6.0_06-b02  
JRE does not need to be updated.  
Installing configuration file.  
Installing license file...
```

```
Installing 7carat tool...
Modifying file permissions...
Creating uninstaller...
Saving configuration.
Done.
```

The script is now finished. The Carat server is now installed but not up and running. Later the server is automatically started at boot time of the host. One may continue to install next component.

8.3 Loupe install (Linux)

Copy 7signal-Loupe-installer from the delivery medium to for example `/home` directory. NOTE! Do not use `/tmp` directory.

Step 1: Move to the directory where installer was copied and install Loupe server by issuing a command:

```
# ./7signal-Loupe-installer.bin
```

You should see output similar to following:

```
Extracting installer, please wait ...
Launching installer.
Checking previous installations ...
No previous installation found.
Enter location to which 7signal Sapphire Loupe will be installed,
installer will create a '/Loupe/' directory under the given path
[/opt/7signal]: <enter>
```

Step 2: the install location

Give the location in the file system to install the Loupe server.

The script continues:

```
Configuration for:
* /opt/7signal/Loupe/apache-tomcat-
5.5.26/conf/Catalina/localhost/7signal.xml
* /opt/7signal/Loupe/webapps/WEB-INF/web.xml
Enter the DB2 username [db7sign]:
Enter the DB2 password [526dc2c2]:
Enter the location of Carat server [127.0.0.1]: <enter>
```

Step 3: Carat server IP address

The Loupe server should run in the same host than the Carat server and therefore localhost numeric address is suitable.

The script continues:

```
Configuration for:/opt/7signal/Loupe/apache-tomcat-5.5.26/conf/server.xml
```


Enter the port for Loupe HTTP server, most commonly 80 or 8080 [80]:
When the non-SSL port is 80, then the preferred SSL port is 443.
Enter the SSL port for Loupe HTTPS server [443]: <enter>

Step 4: ports for Loupe service

As the host is expected to be dedicated for 7signal Sapphire, the default ports for http and https should work fine. However, the ports are freely configurable.

The script continues:

```
Extracting Loupe package ...  
Loupe requires two certificates to run properly. They are delivered  
separately.  
Get certificates from certificate package [Y/n]? <enter>
```

Step 5: Install certificate container and its password

The above mentioned package is not part of the standard delivery. The GUI certificate container and related password are in separate delivery medium in where the folder naming pinpoints the right location for this information. If the certificate and password are copied to the target machine, it is better to remove them after install verification unless one trusts the file system security enough.

The script continues:

```
Please enter location of archive file (<prefix>-7signal-all.tar.gz):  
Found file /root/7signal_storet-7signal-all.tar.gz. Do wish to use it  
[Y/n]? <enter>
```

This option reflects how the user interaction looks like when certificate package install is being used. In case of non-package install the script asks for path to the certificate container and the password.

The script continues:

```
Validating archive..  
Archive valid.  
Extracting files ...  
Extracting passwords ...  
Updating files according to configuration ...  
Finding JRE ... found at /opt/7signal/jre  
Copying init script ...  
Installing init script ...  
Installing 7loupe tool ...  
Creating uninstaller ...
```

```
Loupe install process finished.  
HTTP server configured to URL: http://localhost:80/
```

```
Do you want to start Loupe server now? [Y/n] <enter>
```

Step 6: starting of Loupe server

It is possible to start the server immediately. The requirement is that the database is up and running at the Loupe start-up. It is not mandatory to have Carat up and running at the Loupe start-up but during the first login Carat has to be there.

The script continues:

```
Starting 7signal Loupe server: 7signal Loupe server start complete
```

7signal Sapphire Loupe service commands:

```
service 7signalLoupe start    : Starts Loupe server
(Shortcut: 7loupe s)
service 7signalLoupe stop     : Stops Loupe server
(Shortcut: 7loupe x)
service 7signalLoupe restart  : Restarts Loupe server
(Shortcut: 7loupe r)
service 7signalLoupe status   : Shows if the server is running or not
(Shortcut: 7loupe status)
```

To learn more about the 7loupe-command, simply type command '7loupe' without any parameters.

7signal Loupe server is running

Step 7: install is finished

The Loupe is installed and either up and running or stopped depending on the decisions made during the install.

8.4 Sonar install (Linux)

Copy 7signal-Loupe-installer from the delivery medium to for example /home directory.

NOTE! Do not use /tmp directory.

Step 1: Move to the directory where installer was copied and install Loupe server by issuing a command:

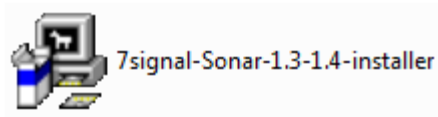
```
# ./7signal-Sonar-x.x-installer.bin
```

The output is omitted as the installation is not interactive.

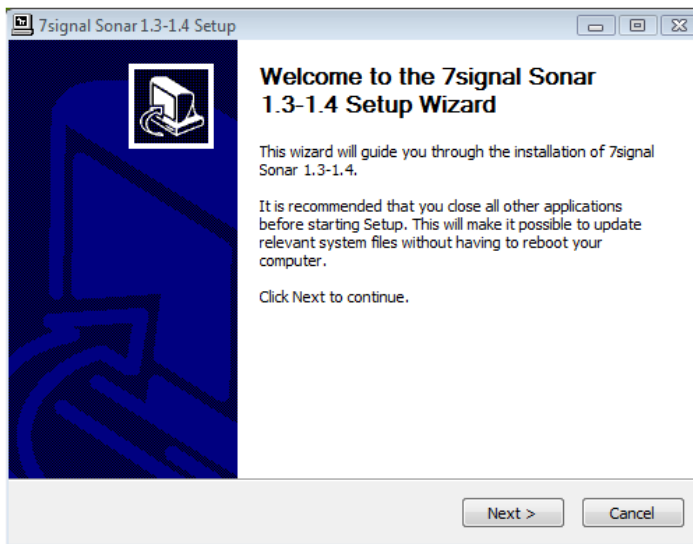
8.5 Sonar install (Windows)

Installing Sonar on Windows platform is possible. In case the corporate business services are running on Windows, it may be desirable to use the Windows platform. The implementation of Windows TCP/IP stack prevents malicious use of the network and as a by-product it typically prevents reaching maximum throughput. If one wants to optimize Windows behavior for maximum throughput, one must note that all the applications in the same server host shall modify their behavior, not only 7signal Sapphire.

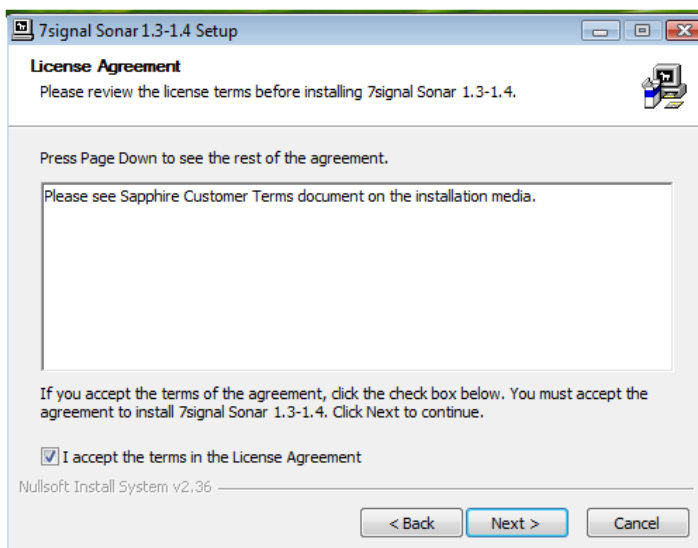
Step 1: Execute Carat Client installer



A double-click on the icon launches the following panel:



Step 2: Accept the License Agreement

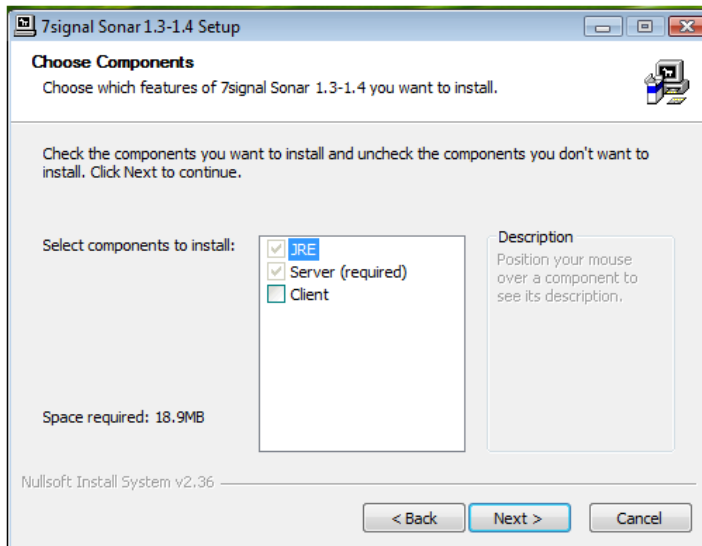


The distribution medium contains *7signal Sapphire Customer Terms* document in the Documents folder.

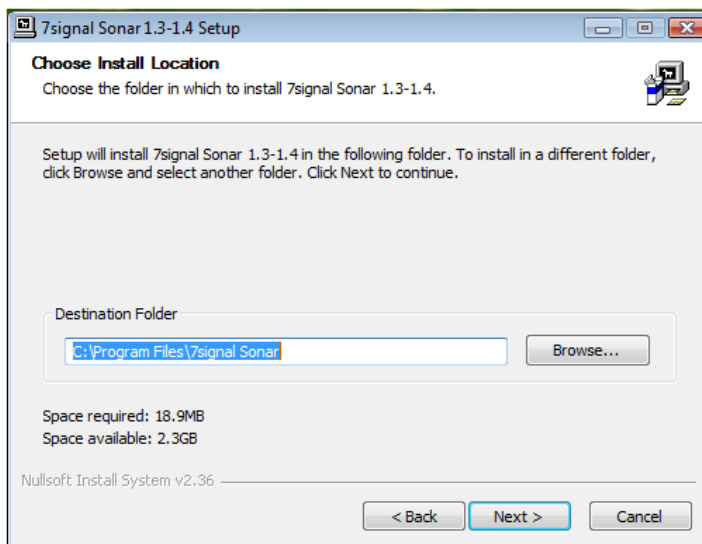
Step 3: Choose the components

This is informative step only: it is mandatory to select both JRE and the Sonar server itself.

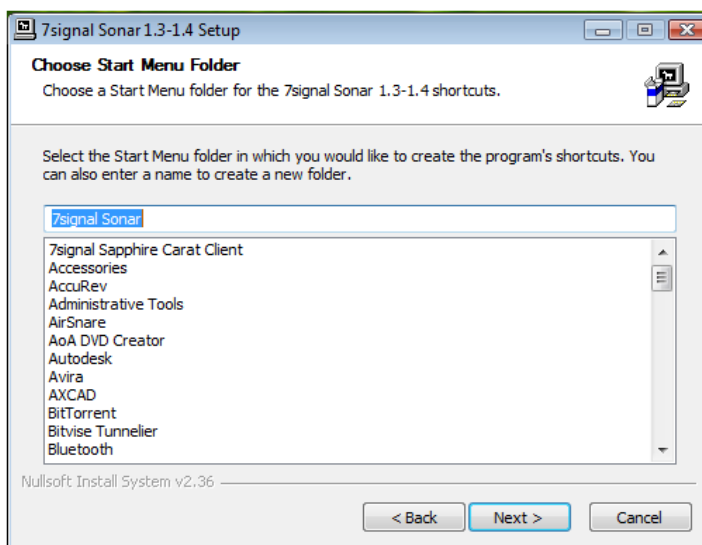
The client install should not be selected. This is not a true Sapphire client software but various scripts for testing purposes.



Step 4: Choose the location for installation

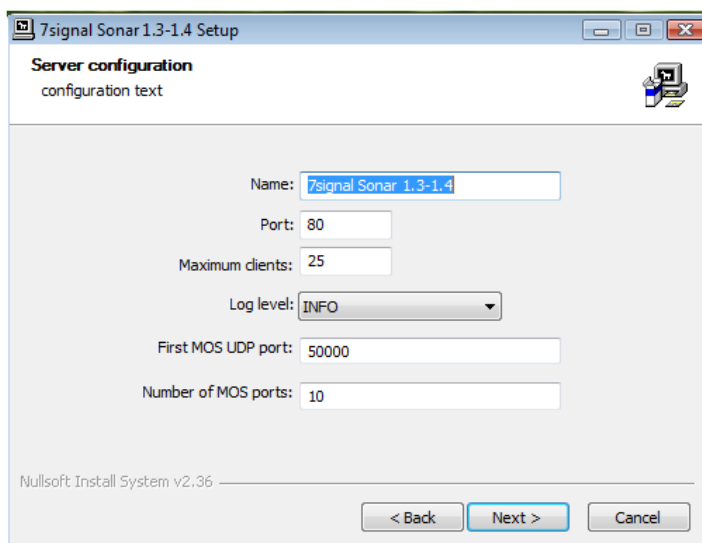


Step 4: Choose the Start menu folder



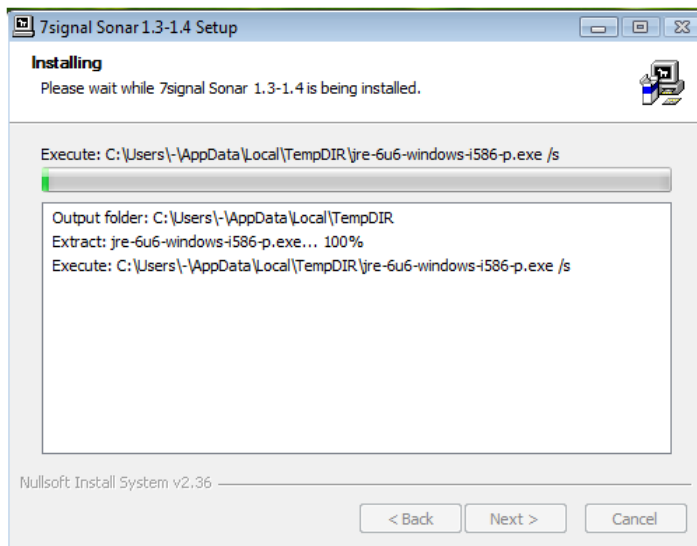
Step 5: Sonar Server configuration

One should see the connectivity section above if one needs or wants to change the defaults for the communication and networking settings.



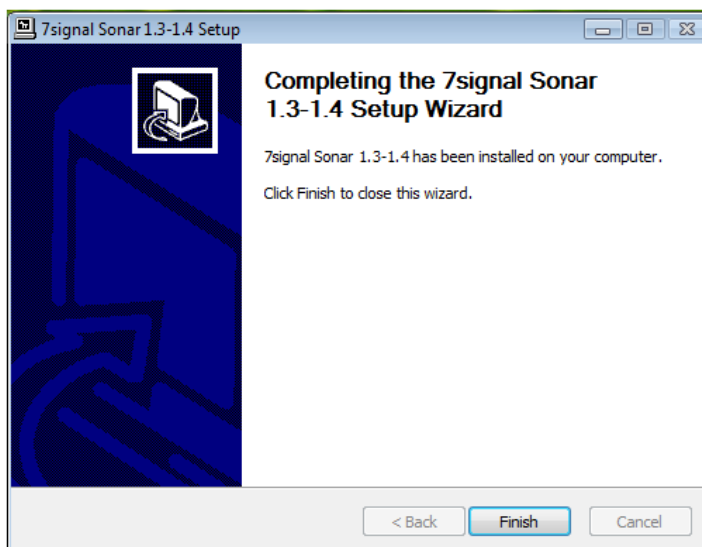
Step 5: The package is being installed

There is no expected user-interaction in this step. During JRE install one should be ready to wait a few moments as the JRE package execution takes some time with no obvious output or other indicator of progress.



Step 6: Finish the installation

Finish the installation. An icon for launching the Carat GUI client should be available on the chosen start-folder.



8.6 Carat GUI install (Linux)

Copy 7signal-Carat-GUI-installer from the delivery medium to for example /home directory.

NOTE! Do not use /tmp directory.

Step 1: Move to the directory where installer was copied and install Loupe server by issuing a command:

```
# ./7signal-Carat-Client-x.x-installer.bin
```

You should see output similar to following:

```
Extracting installer, please wait ...  
Launching installer.
```

Step 2: the destination folder

```
Enter location to which 7signal Sapphire Carat client will be installed  
[/opt/7signal]: <enter>
```

One should enter the path for the desired destination folder.

The script continues:

```
Extracting Carat client package...  
Copying Carat to /opt/7signal...  
Extracting jre...  
JRE already installed, checking if it is up to date  
Installed version: 1.6.0_06-b02  
New version      : 1.6.0_06-b02  
JRE does not need to be updated.  
Updating files according to configuration...  
Text viewer is kedit  
PDF viewer is kghostview  
Creating uninstaller...
```

Step 3: installing the certificates

Carat client GUI requires a certificate to run properly. It is delivered separately.

```
Get certificates from certificate package [Y/n]? <enter>
```

The above mentioned package is not part of the standard delivery. The GUI certificate container and related password are in separate delivery medium in where the folder naming pinpoints the right location for this information. If the certificate and password are copied to the target machine, it is better to remove them after install verification unless one trusts the file system security enough.

The script continues:

```
Please enter location of archive file (<prefix>-7signal-all.tar.gz):  
Found file /root/7signal_storet-7signal-all.tar.gz. Do wish to use it  
[Y/n]? <enter>
```

This option reflects how the user interaction looks like when certificate package install is being used. In case of non-package install the script asks for path to the certificate container and the password.

The script continues:

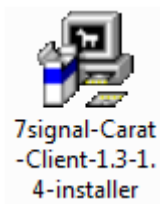
```
Validating archive..
Archive valid.
Extracting files..
Extracting passwords..
Finished.
```

The GUI client may be started from the install directory with the script named `run_client.sh` but there is no desktop icon because of lack of generic support for desktop icons in linux distributions.

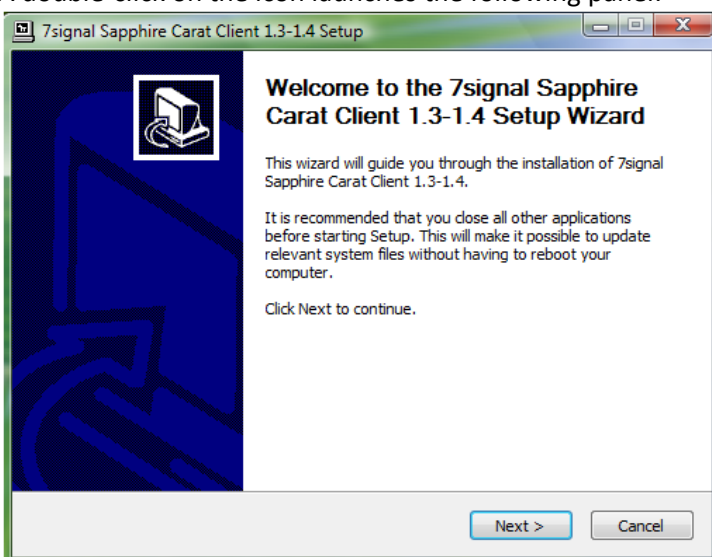
8.7 Carat GUI install (Windows)

The Windows install is a typical for Windows environment: the installer comes as a single executable file that launches a dialog-based install sequence. When the installer file is moved to Windows file system, the operating system recognizes it as an installer file.

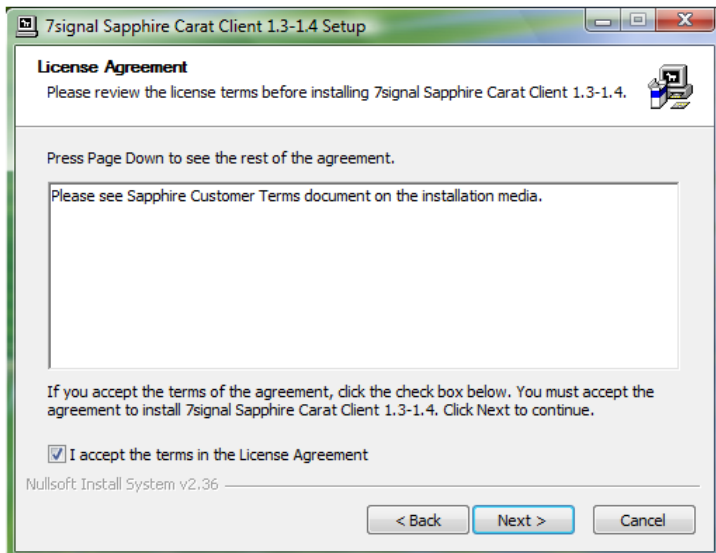
Step 1: Execute Carat Client installer



A double-click on the icon launches the following panel:

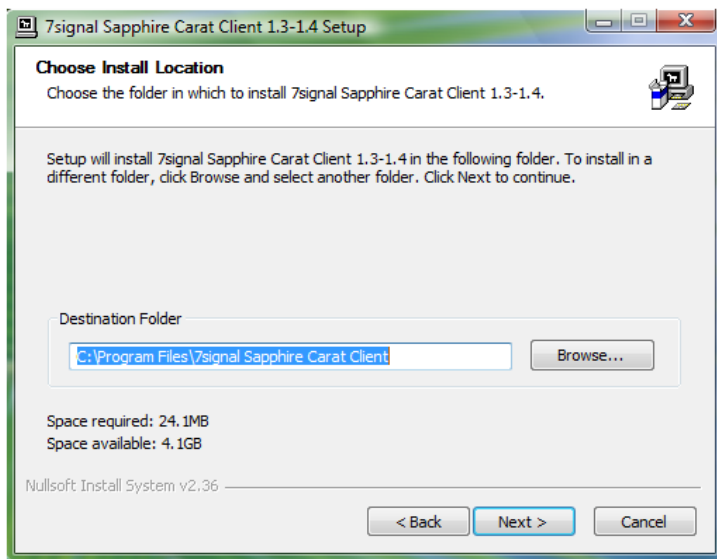


Step 2: Accept the License Agreement



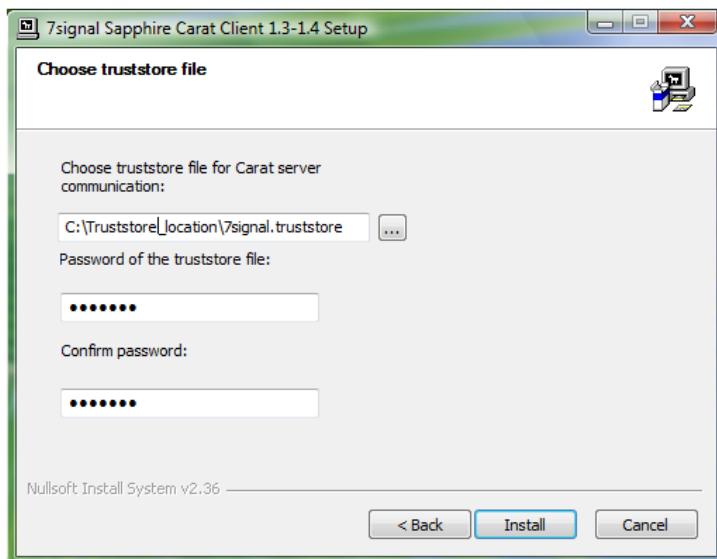
The distribution medium contains *7signal Sapphire Customer Terms* document in the Documents folder.

Step 3: Define the installation Destination Folder



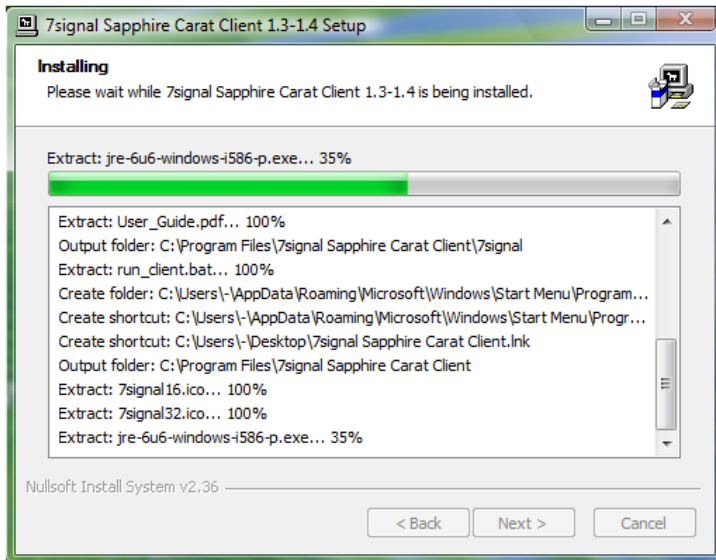
Step 4: Select your 7signal.truststore file and type your truststore password

The PKI encryption infrastructure requires Carat client to provide a certificate. The certificate is stored in a truststore file that is typical for Java SE programs. The truststore file and the password are delivered to all customers with the product package.



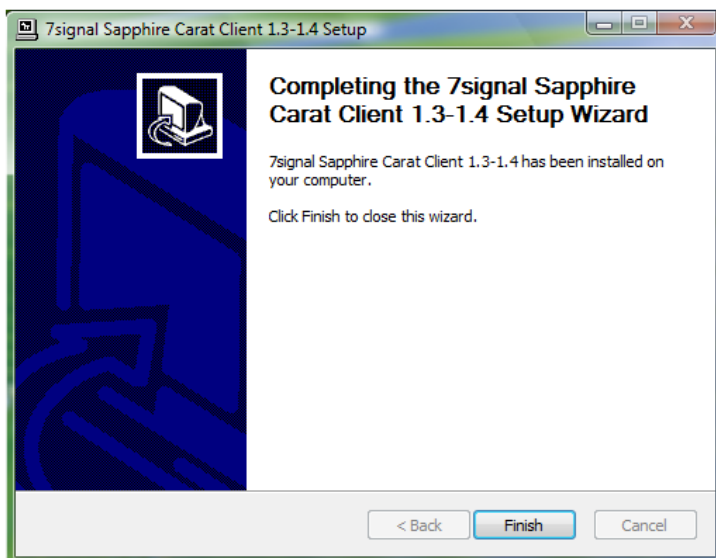
Step 5: The package is being installed

There is no expected user-interaction in this step.



Step 6: Finish the installation

Finish the installation. An icon for launching the Carat GUI client should be available on the desktop.



9 UPGRADING SAPPHIRE

Every official software delivery from 7signal contains Release Notes. It is always advisable to read the Release Notes for the latest information on the software.

However, upgrade instructions seem to vary per releases in such proportion that it is justified to deliver upgrade instructions separately from the software package. This piece of information is provided by 7signal Services and Operations.

The upgrades can be divided into three categories:

- 1) Major version upgrades;
- 2) Minor version upgrades;
- 3) Hotfix upgrades.

9.1 Major version upgrade

Major change is likely to contain a completely new technology or a profound change in the ways of interaction. Database changes are likely. All the components are to be updated.

9.2 Minor version upgrade

Similar to major version upgrade except that minor releases just typically combine the agreed new features.

9.3 Hotfix upgrade

There should not be any change in the database. Currently all the Sapphire elements are updated. 7signal explores a way to lighten the upgrade process regarding the hotfixes.

The hotfixes aim to solve a single problem, malfunction or similar that could potentially stop the system from producing measurements.

10 LOG SETTINGS

All 7signal Sapphire elements have logging capability.

10.1 Carat server log

The log file - `server.log` - is located in `/opt/7signal/Carat/7signal`. The directory contains older log files as well named `server.log.*` where by default the asterisk (*) is in range of 1..5. Altogether, there is one active log file named `server.log` and five files for circulating the files. The oldest logs do get overwritten.

To check the latest logs one should issue the following command:

```
# 7carat log
```

For continuous real-time logging

```
# 7carat log -f
```

The Carat log level can be changed from INFO to DEBUG which produces much more detailed information. The file in default install is

```
/opt/7signal/Carat/7signal/conf/logging.prop
```

and the corresponding lines in the property file are:

```
#root logger  
log4j.rootLogger=[INFO |DEBUG]
```

Other changes in this file are possible and should be according the open license tool named `log4j`. 7signal does not take responsibility of other changes than the logging level.

10.2 Carat GUI log

In Windows by default the log file - `client.log` - is located in folder

```
\Program Files\7signal Sapphire Carat Client\7signal
```

In Linux the log file - `client.log` - is located in folder

```
/root
```

10.3 Eye log

NOTE: as this is Eye logging, all the commands are to be given in the prompt of the monitoring station, not in Carat or Sonar server.

The Eye unit has a circular log that can be followed real-time with the following command:

```
# logread -f
```

Without any arguments the command shows 100 most recent lines of log and returns immediately:

```
# logread
```

The log can be set to a file instead of the ring-buffer with `7config log -` command that has a built-in help.

NOTE! If one moves away from the circular logging, one must maintain the file system and log size manually.

The following command shows the log level and log target information:

```
# 7config log show
```

10.4 Loupe log

Loupe is based on Tomcat so the log file is named *catalina.out* and is by default in directory `/opt/7signal/Loupe/apache*/logs`.

Tool to follow the most recent logging is

```
# 7loupe log
```

and for continuous monitoring:

```
# 7loupe log -f
```

10.5 Sonar log (Linux)

The log file - `sonar-server.log` - is located by default in `/opt/7signal/Sonar/Sonar/log`.

Please use the typical tools for text files such as `more`, `less` or any editor of preference.

11 SAPPHIRE PROCESS MANAGEMENT

11.1 Carat

Carat is a service in Linux systems. However, the Carat process is supposed to be used by 7signal tool called *7carat*:

```
# 7carat <parameter-from-the-bullet-list>
  ○ start
  ○ stop
  ○ restart
  ○ status
```

11.2 Loupe

Loupe is a service in Linux systems. However, the Loupe process is supposed to be used by 7signal tool called *7loupe*:

```
# 7loupe <parameter-from-the-bullet-list>
  ○ start
  ○ stop
  ○ restart
  ○ status
```

11.3 Sonar

Sonar is a service in Linux systems. However, the Sonar process is supposed to be used by 7signal tool called *7sonar*:

```
# 7sonar <parameter-from-the-bullet-list>
  ○ start
  ○ stop
  ○ restart
  ○ status
```

11.4 Eye

NOTE: The following command requires session in the monitoring station.

The 7signal tool *7config* controls the Eye configuration. See more details on the tool on Appendix A. The process is controlled with command group *run*.

```
# 7config run <parameter-from-the-bullet-list>
  ○ start
  ○ stop
  ○ restart
  ○ status
```

12 TROUBLESHOOT

By this far one should have all the processes started and running

12.1 GUI client cannot connect to Carat server

1. Check that username and password are correct in the GUI
2. Check that Carat server is running
 - a. run `7carat status`
 - b. read the Carat server log
 - c. if necessary, issue command `7carat start` and go to b)
3. Check that GUI port 47777 (default) is open in the firewall of the GUI host
4. Check that RMI port 1099 (default) is open in the firewall of the GUI host
5. Check that the Carat server RMI address is the right one in the GUI host
 - a. The script `run_7signal_Carat_mgmt_server.sh` contains the IP address as `_rmiserver_prop` variable.
 - i. the default location for the script is `/opt/7signal/Carat/7signal/`
 - b. Check that this variable has the right Carat server address

12.2 Cannot add Eye unit

1. Check that license.xml file is located in the Carat server
 - a. Check the Carat server log for possible license errors
 - b. Check the existence of the file
 - i. The default location for the license file is `/opt/7signal/Carat/7signal/conf`
 - c. The file permission should be 744.
 - d. Check the contents of the file to see any anomalies
2. Run `7config verify` command in Eye unit
3. Check that maximum number of Eye's (license defines) is not exceeded.
4. Check that `carat.keystore` is located in the Carat server
5. the default folder location is `/opt/7signal/Carat/7signal/conf`

12.3 Scan test failed

When running scans in Carat, one might get error message "Warning, Scan test failed on Eye unit"

1. Is the IP connection OK between Carat server and the Eye ethernet interface?
2. Verify that Eye unit connections are OK
 - a. In Eye prompt run the command `7config verify`
3. Restart Eye software
 - a. In Eye prompt run the command `7config run restart`

12.4 No access to Sonar server, active test failed

1. Check that Sonar server is configured correctly to Carat (Manage|Sonar View)
 - a. IP address and Sonar port
2. Check that Sonar server is up and running

3. Check the process at the host with the command
 - a. `service 7signalSonar status`
 - b. Remotely one can `telnet <sonar-ip-addr> <port-default-80>`
 - i. Sonar opens the connection and closes it after 1 second of idle time
4. Check Sonar log for error messages
5. Check that Sonar ports are open in the firewall(s)
6. Check that the wlan encryption key has correct definition
7. Check that the key is bound to the managed network
8. Check connectivity options and requirements for Eye and Sonar

12.5 Loupe client cannot connect to Carat server

Loupe and Carat are both run in the Carat host machine.

1. Check that username and password are correct
2. Check Loupe log for error messages
 - a. Run command `7loupe log`
3. Check that loupe server is running
 - a. Run command `7loupe status`
4. Check Carat log for error messages
 - a. Run command `7carat log`
5. Check that carat server is running
 - a. Run command `7carat status`

13 COMMAND-LINE TOOL FOR EYE

13.1 Overview

`7config` is a command line utility for configuring various things in Eye unit. Commands are divided into thematic command groups so that each group contains one or more commands. A command may also have an argument and a value.

Currently supported command groups are the following:

- `ip`: IP address management.
- `keys`: Key storage management.
- `ap`: Access point configuration storage management.
- `conn`: Connection management.
- `run`: Software run-state management.
- `txp`: External antenna configuration.
- `log`: Log configuration
- `iface`: Global interface management.
- `verify`: System verification.

Command group specific help can be shown with command

```
7config <group> help
```

General help can be shown with command

```
7config help
```

13.2 IP command group

This command group contains commands for configuring IP configuration of Eye management interface (eth1). Currently, it is possible to show current IP configuration, set IP address, network mask and default gateway address of the management interface. It is also possible to take a backup from current IP configuration, and restore the configuration from the backup.

```
7config ip [VALUE]
```

'set' command arguments:

```
  addr      Set IP address of management interface (eth1)
            VALUE = Valid IPv4 address
  mask      Set netmask of IP address of management address
            VALUE = Valid IPv4 netmask in dotted format
            (x.x.x.x)
  port      Set management port
            VALUE = TCP port number

  gateway   Set IP address of default gateway (optional)
            VALUE = Valid IPv4 address
```

```
'show' command arguments: none

'backup' command arguments:
  create    Create backup from existing IP configuration.
  restore   Restore IP configuration from backup.
```

Examples

Setting IP address of the management interface:

```
# 7config ip set addr <IP_address>
```

Setting network mask of the management interface:

```
# 7config ip set mask <mask_in_dotted_format>
```

Setting port of the management interface:

```
# 7config ip set port <IP_address>
```

Create backup from current IP configuration:

```
# 7config ip backup create
```

Restore IP configuration from a backup:

```
# 7config ip backup restore
```

Show current IP configuration:

```
# 7config ip show
```

13.3 Keys command group

This command group contains command for managing WLAN network keys stored to Eye unit. Currently, the only supported operation is to destroy all wlan keys from the Eye.

```
# 7config keys destroy
```

13.4 AP command group

This command group contains command for managing Access Point information stored to Eye unit. Currently, the only supported operation is to destroy all Access Point information from the Eye.

```
# 7config ap destroy
```

13.5 Conn command group

This command group contains commands for managing encryption settings of management traffic between Eye unit and Carat server. Currently supported operations are to show configured TLS encryption key file name, set TLS encryption key file name, and set password of the encryption key file.

```
7config conn [VALUE]

'cert' command arguments:
  set      Set management connection encryption certificate
           file.
           VALUE = Certificate file name. File must
           reside in /nand/etc/certificates directory.
  show     Show current encryption certificate file name.

'pwd' command arguments
  set      Set encryption certificate password.
```

Examples

Show file name of the configured TLS encryption key file:

```
# 7config conn cert show
```

Set file name of the TLS encryption key file:

```
# 7config conn cert set <filename>
```

Set password of the TLS encryption key:

```
# 7config conn pwd set <password>
```

13.6 Run command group

This command group contains commands for managing Eye software run-state. Currently supported operations are to ask current status of the software, and to start, stop and restart the software.

```
7config run
  status  Show status of Eye software.
  start   Start Eye software.
  stop    Stop Eye software.
  restart Restart Eye software.
```

Examples

Query status of the Eye software:

```
# 7config run status
```

Start the Eye software:

```
# 7config run start
```

Stop the Eye software:

```
# 7config run stop
```

Restart the Eye software:

```
# 7config run restart
```

13.7 Txp command group

This command group contains commands for showing and setting of TX power related parameters. Currently supported operations are showing of TX power settings, setting default TX power, setting gain of an external antenna and setting cable loss of the external antenna.

```
7config txp [ARG] [VALUE]
'show' command arguments:
  default      Show default TX power.
  ext          Show configured gain of external antenna.
  cable        Show configured cable loss of external antenna.
  If no arguments given, all information will be shown.

'set' command arguments:
  default      Set default TX power.
                VALUE = TX power (dBm).
  ext          Set gain of external antenna.
                VALUE = Gain of external antenna (dBi).
  cable        Set cable loss of external antenna.
                VALUE = Cable loss of external antenna cable
                (dB).
```

Examples

Show all information in TX power configuration:

```
# 7config txp show
```

Show configured cable loss:

```
# 7config txp show cable
```

Set external antenna gain to 10 dBi:

```
# 7config txp set ext 10
```

13.8 Log command group

This command group contains commands for configuring log production of the Eye. Logs can be produced either to a ring buffer on RAM (this is the default, can be read by logread command), or to persistent storage on NAND flash in folder `/nand/` as files named `syslog*`.

Reading of the log files is either from the chosen storage directly or with a command `logread`.

By default, only the critical messages are logged. Currently, the supported commands are:

- `show` which shows the current log configuration.
- `set`
 - `level` which sets the current level of logging
 - `default` which sets default level of logging at system start-up
 - `target` which sets logging target, ring buffer or NAND.

Log level set by 'set level' command remains active until restart of the system. Default log level after installation is "ERROR".

Log levels are the following:

- CRIT - Critical messages
- ERROR - Error messages
- WARN - Warning messages.
- INFO - Informational messages.
- DEBUG - Debug messages.

Log levels are cumulative, i.e. the level CRIT logs only critical messages, WARN logs all levels including CRITICAL, ERROR and WARN messages. DEBUG logs all possible messages.

Log command group arguments:

```
'show'          Show log configuration.

'set' command arguments:
  level         Set log level.
                VALUE = CRIT | ERROR | WARN | INFO | DEBUG
  default       Set default log level. This log level will be active
                when 7signal software starts.
                VALUE = CRIT | ERROR | WARN | INFO | DEBUG
  target        Set logging target.
                VALUE = buffer | persistent
```

Examples

Set log level to DEBUG:

```
# 7config log set level DEBUG
```

Set log level to WARN:

```
# 7config log set level WARN
```

Set default log level to ERROR:

```
# 7config log set default ERROR
```

Show default log level:

```
# 7config log show
```

Set logging target to NAND flash:

```
# 7config log set target persistent
```

14 COMMAND-LINE TOOL FOR DATABASE MANAGEMENT

7db command is a tool for Carat database. It supports limited data retrieval, general management and database backup administrator for both immediate and automatic backups.

It is recommended that database backups should be taken regularly.

7db command groups:

- `dump` Dump export and import
- `show` Show status and configurations
- `reinit` Re-initialize databases
- `backup` Automatic backup management
- `logsetup` To change the current logging method
- `db2` Access to database management system command-line tool

14.1 Dump command group

Creates an instant database backup dump or restores previous backups.

Examples

Make a dump to a gzipped tar file

```
# 7db dump export
```

Import a dump

```
# 7db dump import 7signal-dump.tgz
```

14.2 Logsetup command

Changes the way the underlying DBMS handles logging.

NOTE: the command is trivial to issue but it's consequences are highly resource consuming. Observe awareness when using this command.

There are two different logging modes in 7signal Sapphire. This command switches between the modes. There is lots of informative output as this command should not be used carelessly or without proper planning and understanding of the consequences.

The command examines the current state of all three different underlying databases. In case they differ from each other, the processing shall stop as it is expected that all the databases are handled similarly. In case the logging method differs, there has been some significant error in DB administration and system otherwise.

The *logsetup* command may result in numerous backups for the safety reasons so the overall process duration is rather long.

14.3 Backup command group

Creates instant and automatic database backups.

NOTE: the backup policy should be well-planned. Please see the 7signal Sapphire User Guide for further discussion on backup and the options available.

Backup commands:

- `show` Show automatic backup configuration
- `remove` Remove automatic backup configuration
- `set` Configure automatic backup
 - `daily <HH:mm> <backup directory>`
 - `weekly <DDD> <HH:mm> <backup directory>`
<DDD> = Mon, Tue, Wed, etc.
 - `directory <backup directory>`
Backup directory is optional if a backup configuration already exists.
- `now` Immediate backup.
 - `online`
 - `offline`
- `restore` Recovery command

Examples

Remove configuration

```
# 7db backup remove
```

Backup every Wednesday at 00:30 to /mnt/backups

```
# 7db backup set weekly Wed 00:30 /mnt/backups
```

Backup every day at 03:00 to /mnt/backups

```
# 7db backup set daily 03:00 /mnt/backups
```

Change backup directory to /mnt/newbackups, do not change time settings

```
# 7db backup set directory /mnt/newbackups
```

Backup every Sunday at 00:30, do not change backup directory

```
# 7db backup set weekly Sun 01:30
```

Back the system up immediately

```
# 7db backup now offline
```

Restore a known-to-be-good system state


```
# 7db backup restore <backup-file>
```

14.4 Show command group

Shows the status and configuration of the database

Show commands:

- `tabstatus` Show the status of the tables.
 - `all`
 - `<database_name>`
- `conf` Show configuration of the database.

Examples

Show status of the tables in the MEAS7 and MGMT7 databases

```
# 7db show tabstatus all
```

Show status of the tables in the SECUR7 database

```
# 7db show tabstatus secur7
```

Show status of the CARAT7.ap_ftp_qos_test table in the MEAS7 database

```
# 7db show tabstatus meas7 ap_ftp_qos_test
```

Show configuration of the database

```
# 7db show conf
```

14.5 Delete command group

Delete data from the database tables

```
# 7db delete
```

NOTE: use `reinit` to reset 7signal Sapphire, `delete` merely does what it says: it deletes table contents and does not guarantee that Sapphire is usable after the command. The user must know how to restore some sound and complete state of the system before issuing this command.

14.6 Reinit command group

Empty the database and resume initial state of the system.

```
# 7db reinit
```

Examples

Re-initialize the MEAS7 and MGMT7 databases

```
# 7db reinit all
```

Re-initialize the MEAS7 database

```
# 7db reinit meas7
```

Re-initialize CARAT7.ap_ftp_qos_test table in the MEAS7 database

```
# 7db reinit meas7 ap_ftp_qos_test
```