Goodmill router
test report

GOODMILL

Always online

Kainuu Health District organized a system testing for Ambulance Data Connectivity in Kainuu region (Central-Eastern Finland) during summer 2013. This is a public summary of the actual tests, results and summary with suggestions. Goodmill Multi-Channel Routing System was at the core of the test.

TEST KIT

Router

- Installed in the vehicle is Goodmill w24e-R router with external magnet antennas
- The router used total of three networks (WAN links). Two 3G networks – Sonera, Elisa ja Datame(CDMA450)
- The connection via the router to the computer is enabled through a Wi-Fi Access Point connection

Computer

- Computers used in this test were 2 laptops
- The first tests were carried out on the Windows XP operating system, the Goodmill router plus an internal 3G modem (Mokkula)
- Second tests used the Effica Health Care application by Tieto installed on the Laptops
  - This testing was carried out on the Windows 7 operating system with 3G USB modem and the Goodmill router. Both 3G modems used the DNA network

TESTED APPLICATIONS

Effica

- Effica testing was carried out using a test environment which had the same IT requirements as the proper usage environment Effica would have
- The programme requires a non-stop wireless network connection and does not allow any interruptions in the Wi-Fi connection while the registration is being carried out

Citrix

- Citrix remote desktop enables using Effica with a suboptimal internet connection
- Effica runs on the server with a desktop view on the computer of the programme. With CITRIX, Effica does not sign the user out if the internet connection is interrupted for a short period of time
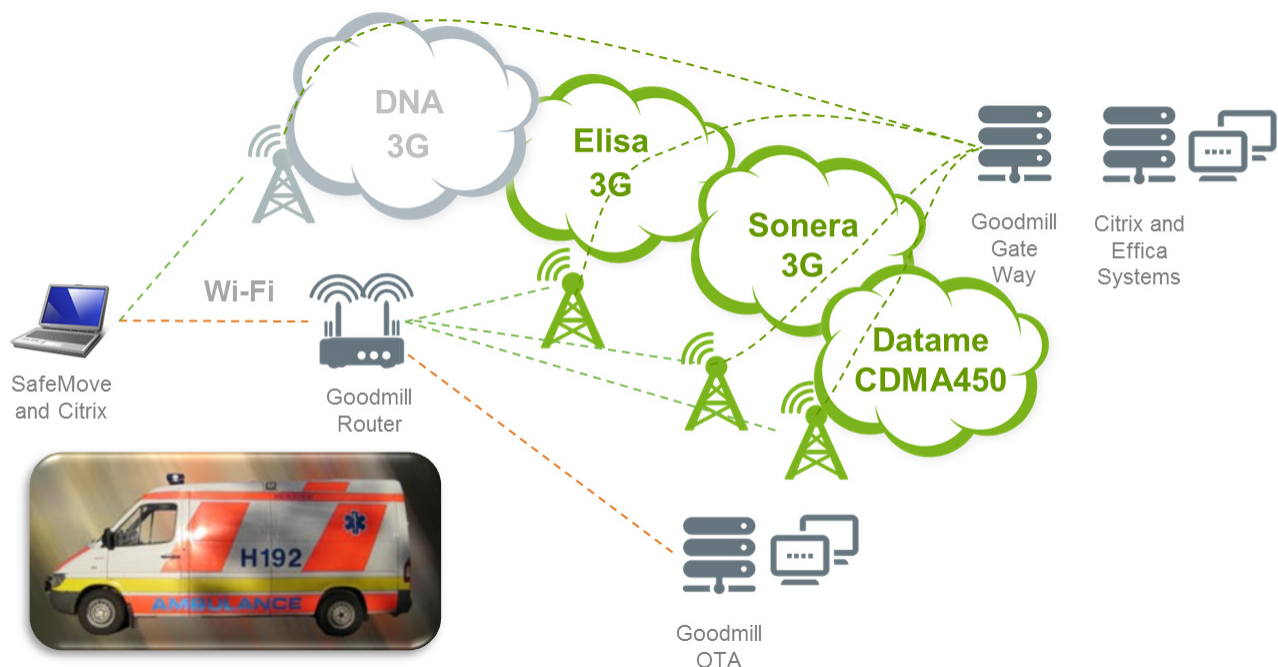
Birdstep Technology Oy, Safemove

- The Safemove programme is needed for creating a password secure connection and changing connection without interruption
- When the connection is directed from the 3G modem to the router it causes the IP address to change - which results in losing the Effica network connection
- A mobile IP address is created by the Safemove programme, allowing the IP address to stay the same, ensuring the internet connection does not get interrupted
- Safemove programme has a vehicle router installed as a priority connection to enable connectivity inside and close to the vehicle. When the Wi-Fi connection to the vehicle is cut, the computer automatically starts using the 3G modem

TESTING METHODS STAGE 1

In the first stage the network availabilities were tested as well as Goodmill Router capability to monitor and select the best available network was tested. At this stage only a router and a computer with a Windows XP operating system was used.

Road Test

The road test was mainly done using a moving vehicle. When the connection was poor the vehicle was brought to a halt.

The reliability of the connection was tested simply by running continuous ping-tests. Ping is a TCP/IP protocol tool which tests the reachability of a certain specified device. Ping sends an ICMP echo request package to the device, which the remote computer responds to with its own echo reply package. Ping tests were sent to the Google server address 8.8.8.8 using the Windows command line.

The upload/download connection tests were carried out using http://speedtest.net.

Apartment Test

The testing methods were the same as in the road test. In each test situation the vehicle was parked about 10-20 metres outside the entrance.

The test locations were:
- The second floor of Kainuu First Aid's building
- The Central Hospital Patient Tower; a concrete apartment block in Kajaani City Centre
- A wood-insulated detached house in Kajaani's Pärsänsuo
- A tiled detached house in Vuolijoki

TESTING METHODS STAGE 2

During the second stage the suitability of Effica software for First Responders was tested.

STAGE 1 TEST RESULTS

Road test with router

The reliability of the internet connection was very good. The connection was not offline for more than ten seconds at a time even in the most remote areas. When the connection was poor the car was stopped which brought the connection speed up again. The minimum connection speed was 1Mbit which is high enough for Effica to function well.

The connection speed was also periodically tested using a single 3G modem without the router. This showed that connection speed was very low outside suburban areas. Effica would not work in these areas.

First Aid Building connectivity

The Wi-Fi connectivity was tested from laptop to the vehicle. The connection to the vehicle router was not interrupted during the whole test period. The vehicle was parked ~10 metres from the main entrance.

Connection speed from the laptop near the building inside the car:

Download	7,68
Upload	2,01
Ping	74

Connection speed inside the apartment:

Download	2.84
Upload	1,53
Ping	75

These both connection speeds are sufficient for Effica.

Patient Tower building connectivity

The vehicle was parked right by the patient tower, the distance to the car was ~20 metres. The Wi-Fi connection from laptop to the router was cut almost instantly when entering the building.

Stone-built Block of Flats in Kajaani City Centre

The vehicle was parked ~10 metres from the main entrance. The connection was lost when entering the building, a further 10 metres from the building's entrance.

Detached house, wood-panelling inside

Vehicle was parked ~10 metres from the main door. The connection was lost in the bathroom as this was farthest from the car. This was likely due to the concrete bathroom wall. The connection was also tested using a single 3G modem.

Connection speeds using a router:

Download	Variable: 2.5-0.3
Upload	Variable: 1.5-0.1
Ping	Variable: 80-100

Connection speeds using a 3G modem:

Download	Variable: 4.5-0.3

The connection speeds were better using a 3G modem in the laptop inside the flat.

Tiled detached house in Vuolijoki

The vehicle was parked circa 10 metres from the main door. The laptop Wi-Fi connection remained uninterrupted. There was very little variation of the connection speed.

Download	3.0
Upload	2.0
Ping	88

STAGE 1 TEST SUMMARY

The connection cannot be guaranteed in all locations, but when in the near vicinity of the vehicle the Datame (CDMA450) connection is very comprehensive nationwide and therefore the connection is fairly reliable.

A router fixed inside the vehicle is needed when using Effica. This enables a reliable and comprehensive network connection. An additional laptop 3G modem connection is needed when using Effica in tall buildings and far away from the vehicle when in suburban areas.

STAGE 2 TEST RESULTS

Road Test
The Effica test environment stayed active and recordable throughout the route. The Wi-Fi connection was active and operational the whole time. Downloading and uploading information went smoothly and without any major interruptions or twitching. The same Effica session was used throughout the road test. At one test point along the Lahnasjärvi Road Effica was working even at ~100 metres from the car. For test reasons there was an inbuilt Wi-Fi antenna in the car which probably shortened the range. A normal set-up would be an outside antenna.

When tested outside the Wi-Fi range, the laptop used Effica using 3G modem although the connection speed was in this case very slow. A speed test for the 3G modem resulted in ping 875 and Download 0.02, whereas the router received Ping 85 and Download 1.08.

A Detached House with a wood-panelling inside
The car was parked in the same spot as in the speed tests, ~10 metres from the main door. When entering the room that was furthest from the car, the connection automatically switched over to the 3G connection. There was virtually no difference in the recording once this happened.
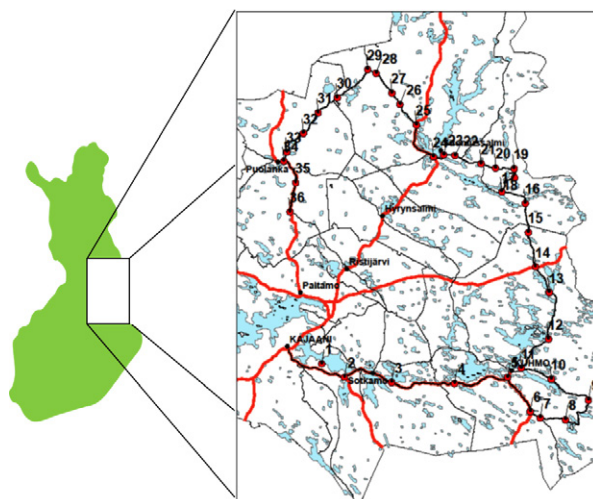
#	klo		Goodmill			Mokkula		
	9.40	1.5.2013	Ping ms	Download	Upload	Ping ms	Download	Upload
1		Haaponiementie	58	8,96	2,20			
2		Vuokatintie	96	1,79	1,31			
3		Kuhmontie	74	4,02	1,83			
4		Sotkamontie	76	10,6	2,48	213	0,19	0,08
5		Sotkamontie & Nurmestie	75	6,32	2,21	120	6,34	1,18
6		Nurmestie 1695	95	6,81	2,67	541	--	--
7		saunajärventie	75	6,12	2,53			
8		saunajärventie	88	3,73	1,04	457	0,03	--
9		Vetkontie 171	73	9,38	2,23	646	--	--
10		Hukkajärventie 1290	161	4,23	2,06			
11		Hukkajärventie & Lentiirantie	149	8,71	2,24			
12		Lentiirantie 2149	129	3,52	1,71			
13		Lentiirantie 4264	139	5,54	218			
14		Lentiirantie 5460	176	1,00	0,61			
15		Kuhmontie 445	92	3,73	0,96			
16		Lentiirantie 6939	76	3,68	2,47			
17		Honkajärventie &Lentiirantie	79	5,46	2,59	905	--	--
18		Honkajärventie	94	1,08	0,30			
19	15.25	Raatteentie 137	88	1,84	1,05	479	0,03	--
20		Raatteentie 62	88	6,48	1,57			
21		Kuhmontie & Raatteentie	88	2,87	1,50			
22	15.54	Kuhmontie 40	120	2,08	0,14	--	--	--
23		Kuhmontie & suomussalmentie						
24		Kalliokatu 2	85	8,23	2,15			
25		5-tie Leväkoskentie	91	7,93	2,11			
26		Leväkoskentie	93	7,22	2,54			
27		Leväkoskentie	101	0,95	0,90			
28		Leväkoskentie	111	3,08	1,16			
29		Leväkoskentie & Vaarannivantie	93	4,30	1,03			
30	18.04	Vaarannivantie	159	0,45	0,21			
31		Taivalkoskentie	94	2,94	0,09			
32	18.17	Taivalkoskentie	266	0,43	0,01			
33		Taivalkoskentie	96	2,33	1,39			
34	18.27	Taivalkoskentie & Paltamontie	96	8,68	1,40			
35		Paltamontie	77	5,35	2,08			
36	18.42	Paltamontie & Ristijärventie	66	7,63	2,30	333	0,19	0,02

When tested outside the WiFi range, the laptop used Effica using 3G modem although connection was in this case very slow. A speed test for the 3G modem resulted in ping 875 and Download 0.02, whereas the router received Ping 85 and Download 1.08.

Patient tower building

The connection automatically switched to the 3G modem and recordability remained the same. The testing continued in the stairwell up to the 4th floor and recording of Effica was also working inside the lift going down.

TEST 2 SUMMARY

Effica works faultlessly using this setup. Switching between connections is unnoticeable to the user and it is likely to be sufficient for Effica over the whole Kainuu region. The connection to Citrix was lost a couple of times but this was due to the user. The same session was still open after logging back into Citrix. So even though the connection was lost in the middle of recording, the data was not lost.

END RESULT AND SUMMARY

It is possible to get the Effica patient database working reliably in ambulances. The router reliability and connection speeds are sufficient in and around Kainuu region. On top of the router, a 3G modem connection is needed because the WiFi connection does not work through thick walls or at distances greater than 100-300 metres from the vehicle.

The Safemove software from Birdstep Technologies Oy is also needed, as this enables the switching of the router and 3G modem connection to ensure that the Citrix connection is not lost.

The system allows for migration into the future, too. The router can be later updated with LTE/4G modems as these networks grow. The platform is also ready for new advanced services like live video streaming from and ambulance to the hospital.

GOODMILL
Always online