FUNCTIONAL SPECIFICATION DOCUMENT 9: COMMUNICATIONS BETWEEN IVU AND BDC

FOR

THE SUPPLY AND INSTALLATION OF DATA LOGGING

AND

AUTOMATIC BUS STOP ANNOUNCEMENT SYSTEM

-

FOR CITYBUS LIMITED

TABLE OF CONTENTS

0. DOCUMENT CONTROL INFORMATION

This document is subject to formal change control procedures as required by KGIS'S quality management procedures. All proposed changes will be offered for review and acceptance to the Customer prior to formal release. The distribution and overall maintenance of this document will be co-ordinated by KGIS's Project Manager. External copies will be distributed in accordance with the Customer's agreed distribution list.

AMENDMENT HISTORY

Issue	Date	Change Description	Originated by	Approved by
1.0	30/01/2008	First Draft Issue for Comment	Tara Nair	

1 INTRODUCTION

~~9.3~~This document describes details of the download communications protocol used by the BDC to communicate with the IVU.

Formatted: Bullets and Numbering

2 DOWNLOAD/UPLOAD METHODS

The BDC supports a generalized lossless file transfer protocol to allow data to be downloaded to and uploaded from the IVU. The file transfer protocol is as follows:

BDC will check connection at specified time periods.

If the central server database connection is down:

- It will show message on BDC
- Send “noupdate” to IVUs when they login.
- It stops checking software update for IVUs.
- It continues to receive file uploads from IVUs.

If the central server database connection is resumed or up:

It will show message on BDC

- Check any update for IVUs when they login
- Check software update for IVUs.
- Analyse files uploaded from IVUs and write to database.

The communications process used between the IVU and the BDC is as follows:

2.1 IVU to BDC Communications

1. After logon and receiving a UDP message from the BDC, the IVU will send files to BDC through HTTP. If the files are very large, it will show the progress of upload.
2. After receiving the file, the BDC will analyse the file contents and update the content to the central server database.
3. If BDC is disconnected from the central server database, it will continue to receive and save files from IVUs. When the database connection is resumed, it will import files to database.
4. Then, after import file to database, it will move the files to a storage location.

2.2 BDC to IVU Communications

BDC In / Out	Command	Action
Sent	BDC IP,HTTP port,TCP port	Broadcast UDP message to port 12000 e.g. 192.168.1.90,80,8080
Receive	login,Bus_ID,software_version_number	1. BDC will check Bus_ID and version to see if there is any update required to IVU.
Sent	"noupdate" or "update,command_filename,md5"	1. If there is nothing update, it will send "noupdate" to IVU. 2. If there is a software update then the BDC will gather all commands and combine into a file and zip Bus_ID_cmd_Timestamp.txt.gz), then send "update,command_file_path,md5" e.g. update,3305_cmd_20071219093923.txt.gz,ad67d279c160753f706aeb25ff272eaa
Receive	cmd_dl_ok, Bus_ID _cmd_Timestamp.txt.gz , command_line	1. If there is no command_line, update database that the IVU has updated successfully and delete the command_filename 2. If there is a command_line then regenerate the command_file according to command_line which has a different timestamp and re-send this to the IVU
Receive	cmd_dl_fail, vehicle_LLI _cmd_Timestamp.txt.gz	1. delete command file according to command_file_path 2. regenerate command file which have a different timestamp and re-send to IVU
Receive	"sw_dl_fail,line number" or "absa_fail, line number" or "log_fail, line number" or "logval_fail, line number"or "cmd_msg_fail, line number"	sw_dl_fail :cannot download software absa_ fail :cannot download software log_fail : logger parameter error logval_fail : logger value error cmd_msg_fail : unknown command

3 FILE SIZES AND FORMAT INFORMATION

The detailed file formats which contain the data required for the system operation will be included with the Software Protocol and File Format License that will be delivered at the end of the project. All file formats are textual formats allowing easy reading and easy addition of new fields and values. In order to minimize the impact of using longer textual data labels data is zipped before transmission. File sizes are highly dependent on the vehicle operation so the assumptions made during this calculation are given.

3.1 Sizes of Data Download

The DL system produces two blocks of data
- DL Events
- Detailed Data Log (DDL)

The ABSA/MBSA system produces two blocks of data
- ABSA/MBSA Events
- ABSA/MBSA Location Log

DL Events Size
For DL Events, assume bus operates for 14 hours per day, generate 120 event messages per hour, each message is 40 characters long.

14 x 120 x 40 = 67KBytes per day

DDL Size
For the DDL, assume each bus generate 5.92MByte per day. This is a measurement figure using experimental data on route 15.

5.92MByte per day = 5920KBytes per day

ABSA/MBSA Events Size
For ABSA/MBSA Events, assume each bus has 10 routes in 14 hours, each route consists of 35 stops, 10 ABSA/MBSA Events are generated of each stop, each message is 40 characters long, with an additional 10 messages for each route.

((10 x 10) + (10 x 35 x 10)) x 40 = 144KBytes per day

ABSA/MBSA Location Log Size
For the ABSA/MBSA Location Log, assume bus average speed is 30 km/hour which if the Location Log record is to be written every 15m will result in a record once every 2 seconds. Each message is 80 chars long.

80 x 30 x 60 x 14 = 2016 KBytes per day

Total Data Download Size
Based on these assumptions the total daily download will be:
67KB + 5920KB + 144 KB + 2016KB = 8147KB

3.2 My SQL Database Size

For data logging and ABSA/MBSA event records, the MySQL record size = 84 bytes

For a DDL log record, the MySQL record size = 121 bytes

For an ABSA/MBSA Location Log record, the MySQL record size = 50 bytes

	Data Logging Event	Data Logging Detail Data Log	ABSA Event	ABSA Location
Total number of records	1680	50400	3600	25200
Record size(byte)	84	121	84	50
Total (KB)	142	6005	302	1260

Total MySQL size per day = 142 +6005+ 302 +1260 = 7.709MB per bus per day

So for a fleet of 650 buses the daily MySQL database will be 650 x 7709KB = 5.01GB.

To allow the exception report to stand alone, which allows for backing up the detailed data without affecting access to the report, a copy of the relevant data is made and it is estimated that a full exception report will take up to 1.5 GB of storage.

4 EXPECTED UPLOAD TIME DURATION

All data transmitted from the IVU to the BDC is zipped and we assume that the compression rate is 4:1.

The daily data size calculated in 3.1 is 8147KB per day.

Compressed this will be 8147KB / 4 = 2037KB

The BDC LAN will be configured to provide at least the equivalent of 5 simultaneous 10Mbps links. The typical upload speed in Depot tests is around 350KB/sec.

This will result in a raw data transfer of 2037KB in 2037KB / 350KB/sec = 5.8 seconds.

Additional time of a further 20 seconds is budgeted for protocol messages and file verification, but this falls well within the 45-second download requirement.

~~2.1~~

5 CALCULATION OF SERVER STORAGE SPACE

A fleet size of 650 Buses is assumed

The server shall store all system data and route data

10GB(estimate).

The server shall store all DDL and ABSA/MBSA Position logs for a period of 14 days

14 x 650 x (6005 + 1260) = 66GB

The server shall store all DL and ABSA/MBSA Events for 90 days

90 x 650 x (142KB + 302KB) = 26GB

The server shall store exception reports for 14 days

14 x 1.5GB = 21GB

50% additional space will be provided.

Total size recommended is (10GB + 66GB + 26GB + 21GB) x 1.5 = 185GB