SERVICE SUPPORT AND BUSINESS APPLICATIONS SERVICE LINE
LOGISTICS APPLICATION SERVICES

LOGFAS NETWORK CONFIGURATION WITH REPLICATION

Table of contents

Document change log			
Version	Comments	Date	Author
1.0	Initial version	24 MAR 2017	Robert Simmons, Marius Rofel
1.1	Revision	29 MAR 2017	Lukasz Pajak
1.2	Revision	04 APR 2017	Robert Simmons
1.3	Final revision	11 APR 2017	Lukasz Pajak

1. APPLICABILITY

LOGFAS 6.2.3 (64-bit operating systems)

2. PROBLEM DEFINITION

LOGFAS database(s) synchronization (refresh) for users in remote sites, according to their roles within a joint multinational activity (exercise), under uneven network connectivity conditions.

3. PROBLEM INVESTIGATION

LOGFAS clients can be connected to any server database, and information will be synchronized to the other servers automatically while the replication services are running. Please refer to the administration guide to find out what data is synchronized (especially the section about excluded tables). ACROSS / UMM / SPM / SDM tables, system tables and background data (RIC/networks) are excluded by design and will have to be synchronized manually. Some tables are updated by triggers (system tables, EVE history tables) and are therefore excluded, but when the main table is updated by the replication service the trigger will take care of the related table.

The SSBA SL LAS group mounted a virtual network environment to simulate a real operational configuration.

3.1. Investigation Areas

a) Multi-leveled C2 and execution chain within the data flow: multiple levels of commands involved, with a number of contributing organizations and formations.

Network design options were explored in order to configure the LOGFAS system according to the roles and responsibilities of the users and clients.

The LOGFAS network architecture generally in use (for supporting the latest activities) consists of a central data source at the JLSG level (under JTF HQ), which ties in the upper (strategic) and the lower (component commands) vertical levels. This also includes the entities involved by the horizontal (PODs, NSEs etc.) structure. The structure supports the required data flow and is in line with the current logistics policies and procedures (other network designs were considered not adequate to the requirement).

The following issues have been identified in this area:

- Increased dependency on the central data source;
- Large number of contributing organizations and formations requiring data synchronization.

b) Multiple roles impacting/retrieving a unique dataset, with different expectations: data input/consumer from different communities inside the logistics domain (M&T, LOGREP) and visibility for other domains (NCOP).

The following issues have been identified in this area:

- The data is usually split in two databases, one for M&T and the other for LOGREP purposes;
- Large dataset size that is often not completely prepared for the execution phase (inherited from the planning stage i.e. MNDDP);
- LOGREP update procedures are manual and the toolset isn't entirely developed (e.g. consumable reporting integration when splitting/merging profiles, no history in LDM as in EVE);

- Users' permissions control in order to distinguish between responsibilities and roles (not usually applied as two databases are used separately for M&T or LOGREP purpose).

c) Uneven network conditions: limited bandwidth links between the remote sites (up to 256 KB/s in the testing scenario) and permissive local networks.

As well as the 3 issues above, technical solutions were investigated in order to provide the best configuration for the current LOGFAS tool set and to identify possible development directions. The Replication service was used to reproduce usage over limited connection links (the data exchange from the central hub to the remote sites). A remote connection to a server database and the use of EVEWEB were also tested as alternatives.

The following issues have been identified in this area:

- Limited connectivity between central data source and remote sites (poor LOGFAS performance/responsiveness when working by remote connection database/EVEWEB);
- Data transfer from contributing organizations and formations is largely bidirectional, although not always necessary.

3.2. Investigation (Testing) Environment

Three servers were used in a virtual environment (one master and two slaves for the replication service), as bidirectional and master to slave replication (direct method only, no XML gateway), in order to test the ramifications between the central hub and remote sites. Remote connection database and EVEWEB tools were also considered as an alternative for the 'spokes', but mainly for the client machines to reproduce the usage within a local network from a remote site.

A 'Net Limiter' tool was applied to the master and/or slave replication servers, in order to limit the bandwidth to up to 256 KB/s, as to work under limited connectivity conditions within the ramifications. The limiter was not used for the client machines within a remote site.

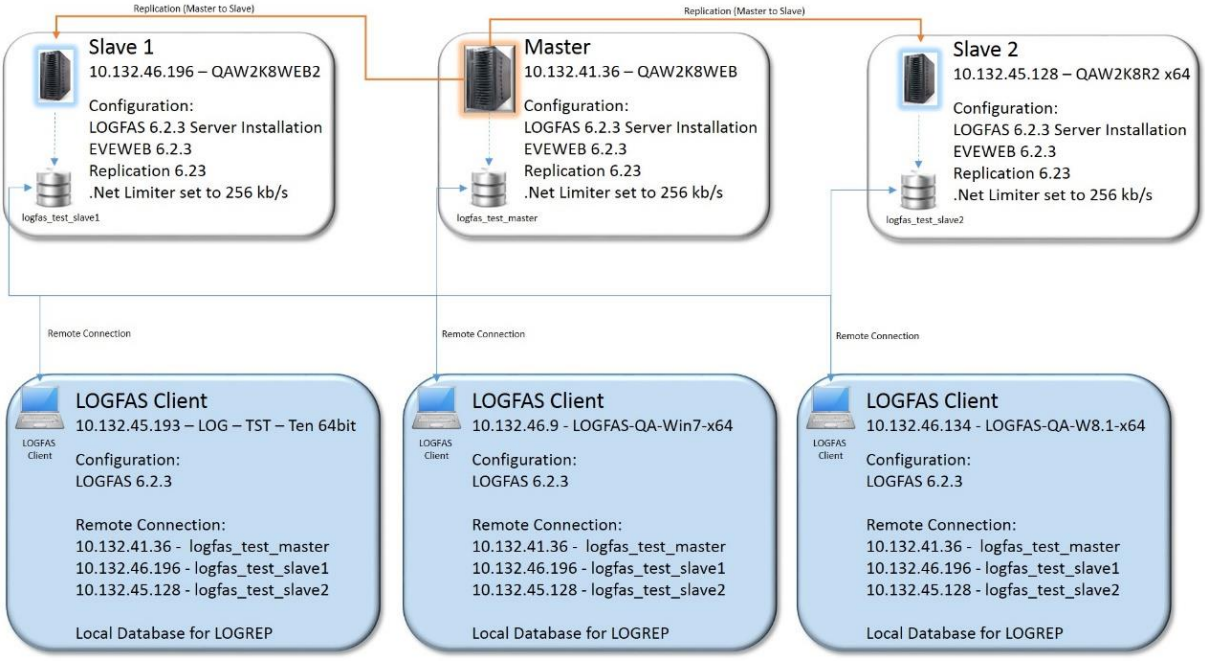


Figure 1. Master to Slave Configuration

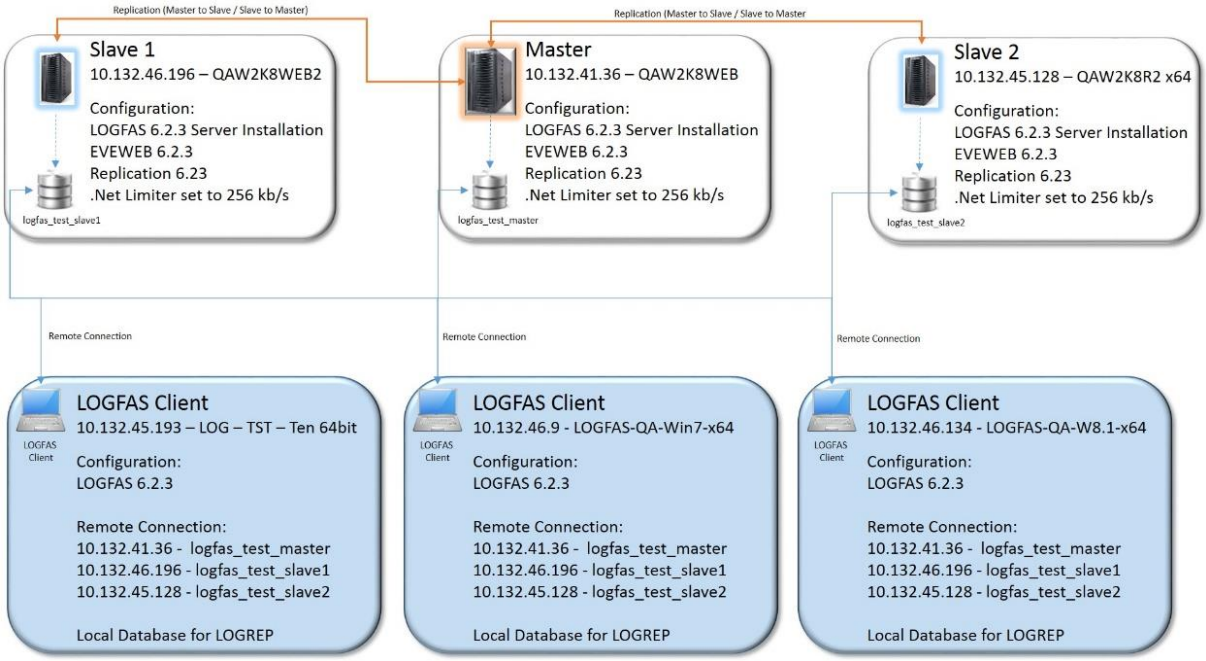


Figure 2. Master to Slave – Slave to Master Configuration

4. TESTING FINDINGS

4.1. Database

Database(s) structure and content may be scrutinized in order to reduce the number of databases in use and their content to the purpose. This also includes **converting the data from the planning stage to the execution phase**, by striping the dataset off some specific files (DDPs, national profiles and holdings etc.), which will increase speed over limited connections. Moreover, it is recommended to use **one database only, for both M&T and LOGREP purposes**, but with the necessary UMM permissions in place. Detailed instructions in this respect are provided in NCIA LOGFAS M&T DATABASE CONFIGURATION FOR REPLICATION guide.

After investigating if any additional tables (apart from the ones omitted by default) could be excluded from the replication service, it was determined that **no tables' exclusions may be safely applied in terms of data consistency/replication service stability**, considering the multiple PK-FK relations present in the databases (only 18 tables have been identified, but actually having no influence on the replication performance – see Annex D).

4.2. Replication vs. single master database

When comparing the data transfer statistics (example in Annex B) if using multiple remote connections to the master database and EVEWEB tools (directly from the clients, with no slave servers in the remote sites) or if using the database replication service (bidirectional) between the central hub and the remote sites, it was determined that both have a similar network traffic load, but the first would have a major impact on LOGFAS performance on the clients' machines, while the latter would make LOGFAS usage more responsive for the users (on the expense of not always having access to the latest data in the system).

	PRO	CON
Database replication service (bidirectional)	good local LOGFAS performance and stability	delayed data refresh (on cycles)
Remote connection database and EVEWEB usage	instant data refresh	poor local level LOGFAS performance (impaired responsiveness)

4.3. One way vs bidirectional replication scenario

If the single shared database (M&T and LOGREP) option is used, regarding LOGREP procedures, there are two variants, involving either one way (master to slave) or bidirectional replication, and the updates (file imports) to be done into the master database, respectively directly into the relevant slave databases (when the latter doesn't have M&T input responsibilities also). This also calls for different force profiles and holdings to be build, either for the entire force or by component commands for example. When comparing the data transfer statistics (example in Annex C) for these two methods (one way replication and email traffic against two ways replication), it resulted there is no significant difference.

Including the LOGUPDATE process on a bidirectional replication architecture will result in more LOGFAS clients requiring a full LOGFAS installation. This may require upgrades to UMM for the LOGFAS modules.

4.4. Recommended settings

The working assumption in terms of performance, as in a balanced ratio between stability and refresh latency, was that a 10 minutes interval is acceptable for the data to be regularly updated for all users involved in a complex scenario. In this respect, 'LOGFAS Replication Error Resolution and Tweak Guide' recommended settings were applied in the replication configuration file, resulting the following recommended values:

Parameter name	Value
CommandTimeout	600 milliseconds
ReplicationFrequency	5 minutes
IncrementalReplicationInterval	1 hour

In addition to abovementioned settings it is recommended to set up the following:

Additional recommended setting	
RecentChangesSearchRange	15 minutes

4.5. Replication performance

Under the above described settings, for regular updates (force profile and holdings, missions times/statuses/manifests, MRFs, PAX requests, etc.) **the replication cycles take around 10 minutes (from the slave to the master and back to the other slaves)**, as expected.

In case large size updates/file imports are applied (FEPs of up to 8 MB and FPH of up to 30 MB in size were tested), the replication runs stably but a cycle may extend to **up to 40 minutes**, because the replication service was not designed to cope with such requirements. An exception to the above is the **large DDP files imports (starting with 2 MB in size) causing numerous PK-FK relations errors and for the service to crash eventually**. This is why, beside the recommendation to streamline the dataset for the execution purpose, this types of files are proposed to be excluded from the database(s) in use or at least to control its access through strict UMM (data) permissions.

5. SOLUTION

Taking into consideration the previous and current paragraphs, **two LOGFAS networks models are proposed in Annexes A1 and A2**.

a) The Replication server database was configured in accordance with the guidance laid down in the NCIA LOGFAS M&T DATABASE CONFIGURATION FOR REPLICATION guide. In this guide it demonstrates how the Multi-National Flow Execution Plan (MNFEP) is to be exported out into a clean database to streamline the amount of data which is replicated. Before this is done, it is essential that the Multi-National Detailed Deployment Plan (MNDDP) is initialized in EVE before it is exported.

b) As replication is used in the execution phase of the Operation or Exercise, the MNDDP is no longer relevant, it is strongly recommended that this portion of the database is eliminated. Any Networks used by CORSOM and EVE for future planning should also be exported from the original database and imported into the clean database.

c) Two models for the Replication process were explored, Replication one way from Master to Slaves (**Error! Reference source not found.**) and Replication both ways from Master to Slave and Slave to Master (Figure 2**Error! Reference source not found.**).

5.1. Replication Configuration for One Way - Master to Slave with limited Both Ways - Master to Slave and Slave to Master

This Replication model was set to Master to Slave for the Component Commands with limited Master to Slave and Slave to Master from the Ports of Debarkation. This is the preferred and recommended model (Annex A1).

M&T Mission and Pax/Cargo requests are performed either by emailing EVE templates to the booking cells or submitting requests directly to the Master database using EVEWEB.

This process is not without its risks, to mitigate those risks it is strongly recommend that the Component Commands (CCs) undertaking the LOGUPDATE for their Forces, work on a local database. The LOGUPDATE can be complied compiled and exported from the local database and sent via email to a central location where it is imported into the master database. This will mean that the combined LOGUPDATE from the JLSG would be replicated down to all the Slave databases. This will eliminate the Master overwriting their data on every replication cycle.

The Ports of Debarkation (APODs/SPODs) were set to replicate both ways to illustrate the arrival and departure procedures. It should be stressed that if connectivity allows they should remote directly into the central data source.

5.2. Replication Configuration for Both Ways - Master to Slave and Slave to Master

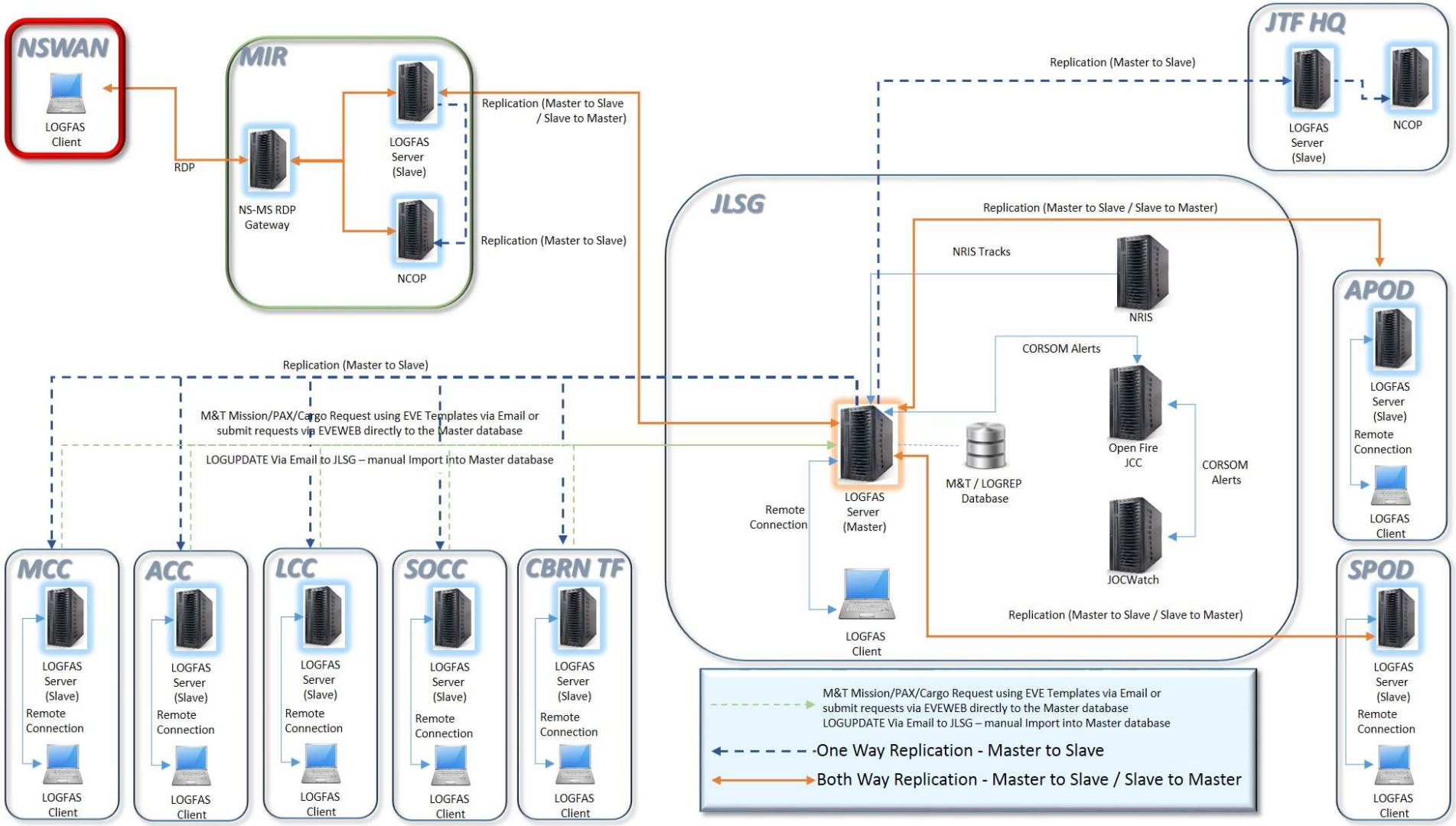
This Replication model was set to Master to Slave and Slave to Master. This is seen in Annex A2 and could be the evolution of replication as LOGFAS transitions to LOG FS.

In this model the Movement and Transportation (M&T) data as well as the LOGUPDATE is replicated between Master and Slaves. This could make the need to export the LOGUPDATE redundant but there is no mechanism in place to record if and when a LOGUPDATE has been applied by any

subordinate commands. The current simple but effective process of exporting a LOGUPDATE and transmitting to the next level is a clear indication that subordinate commands/units have conducted their required tasks to provide timely and accurate data to the next level. If the LOGUPDATE was conducted directly in the slave database and replicated to the master, there is currently no way to record the history of these transactions in LDM. A history, similar to that in EVE would be required to be able to conduct investigations into who has supplied an update or who has corrupted the data.

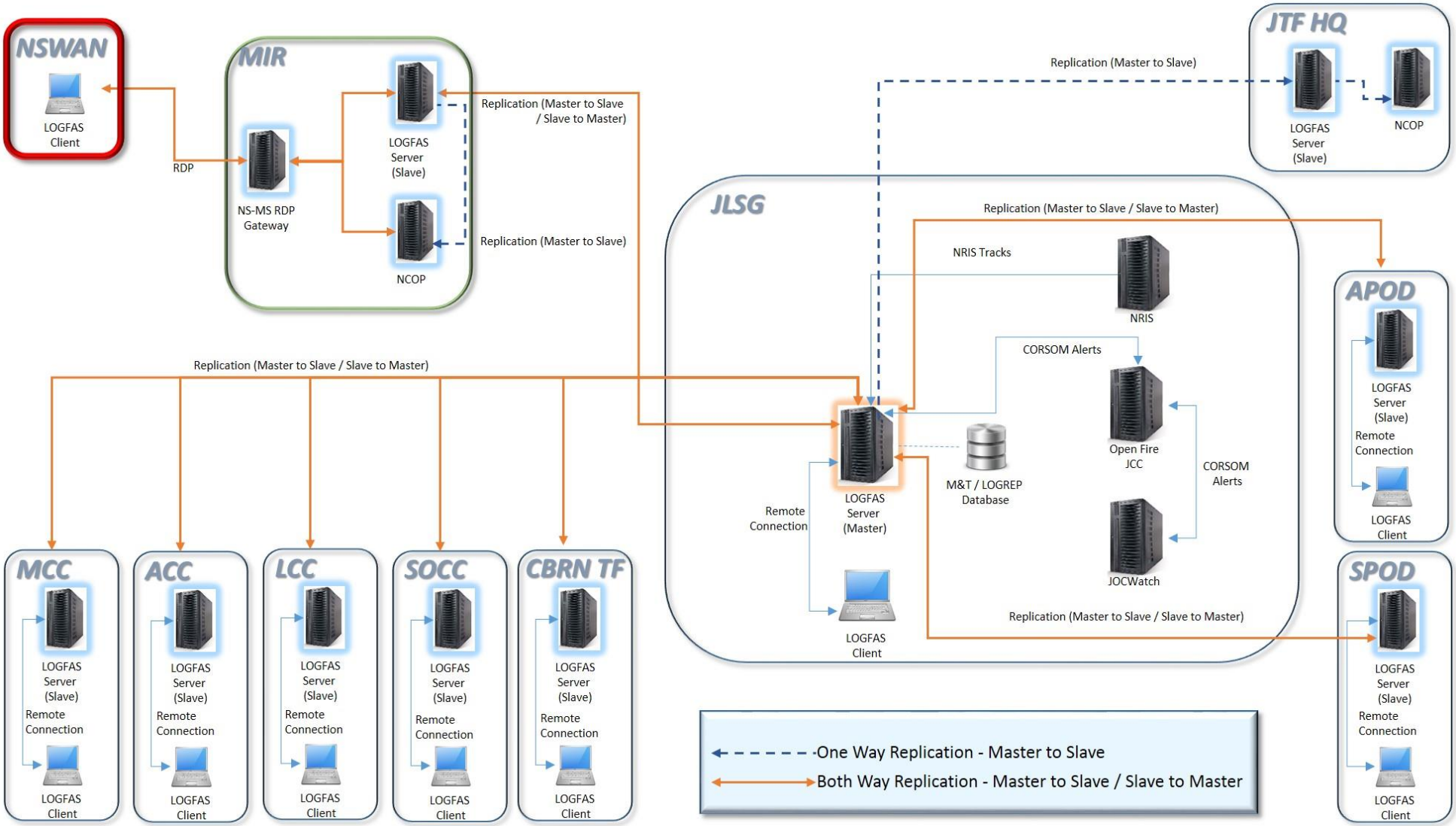
Annex A1

LOGFAS REPLICATION CONFIGURATION FOR ONE WAY - MASTER TO SLAVE



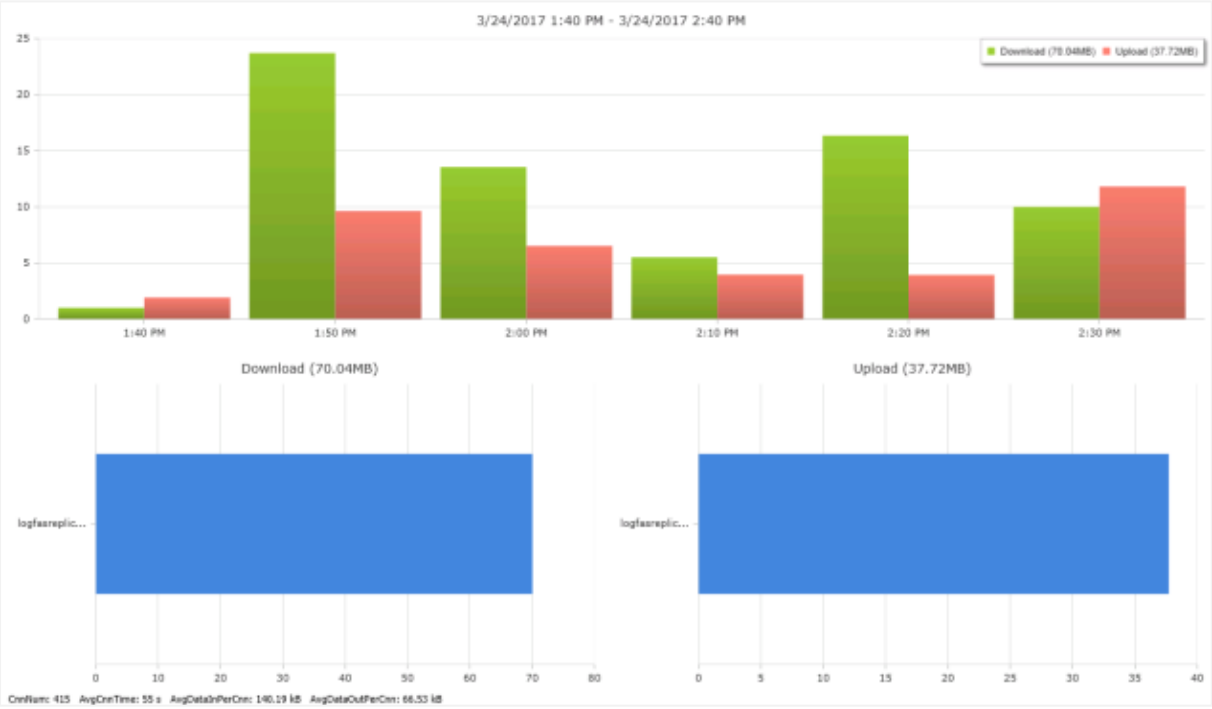
Annex A2

LOGFAS REPLICATION CONFIGURATION FOR BOTH WAYS - MASTER TO SLAVE AND SLAVE TO MASTER



Annex B

DATA TRAFFIC COMPARISON
MULTIPLE REMOTE CONNECTION DATABASES AND EVEWEB USAGE VS. TWO WAYS REPLICATION

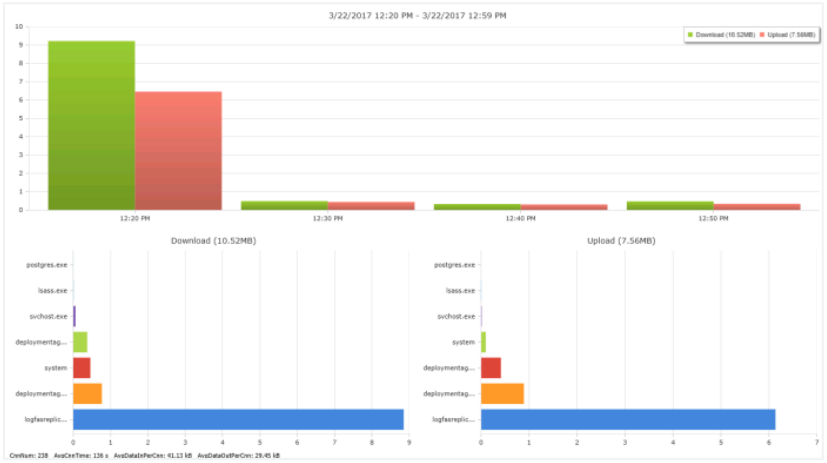


Multiple Remote Connection Databases and EVEWEB Usage

Two Ways Replication

Annex C

DATA TRAFFIC COMPARISON
ONE WAY REPLICATION AND UPDATES BY EMAIL VS. TWO WAYS REPLICATION (LOGREP ORIENTED)



One Way Replication and Updates by Email

Two Ways Replication (LOGREP Oriented)

Annex D

TABLES THAT COULD POTENTIALLY BE EXCLUDED FROM REPLICATION

#	Table name
1	CapabilityCodeVersion
2	Command_Relationship
3	Commitment_Status
4	ComponentMovementDependency
5	Data_Classification
6	Edge
7	Function
8	Item_Picture
9	MOV_PlanningParameter
10	Mov_Track
11	MOV_TrafficabilityStatus
12	Ref_Fuelling_Method
13	REF_FuellingStationSupplyMethods
14	REF_FuelType
15	REF_MedicalFacility_Role
16	REF_MedvacType
17	REF_MultimediaType
18	Region