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D8.7 - Third input to WP2 concerning first level support

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Abstract	This deliverable is a third input form First Level Support to the architectural work of Fed4FIRE
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	P	Prototype	
	D	Demonstrator	

	O	Other	
Dissemination level	PU	Public	X
	PP	Restricted to other programme participants (including the Commission)	
	RE	Restricted to a group specified by the consortium (including the Commission)	
	CO	Confidential, only for members of the consortium (including the Commission)	

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Executive Summary

This deliverable considers the historic experience of operating First Level Support as part of the Fed4FIRE federation. It looks at the experience of operating the dashboard that was developed in response to the initial input to the architectural work of FLS and notes the changes already being implemented to the dashboard to improve its basic functionality.

The deliverable also considers the broader experience gained from FLS operations over a period of eight months as well as the implications of other developments that have taken place within the project which affect the current context of FLS. On the basis of this analysis six new recommendations are made to WP2 for their consideration in the overall architecture of Fed4FIRE.

Acronyms and Abbreviations

FLS	First Level Support
MIB	Management Information Base
RAG	Red, Amber, Green (Alarm Status)
SNMP	Simple Network Management Protocol
TTS	Trouble Ticket System

Table of Contents

1 Introduction – Current Implementation of First Level Support

The original concept of First Level Support (FLS) was described in deliverable D8-1. Figure 1 below summarises the approach.

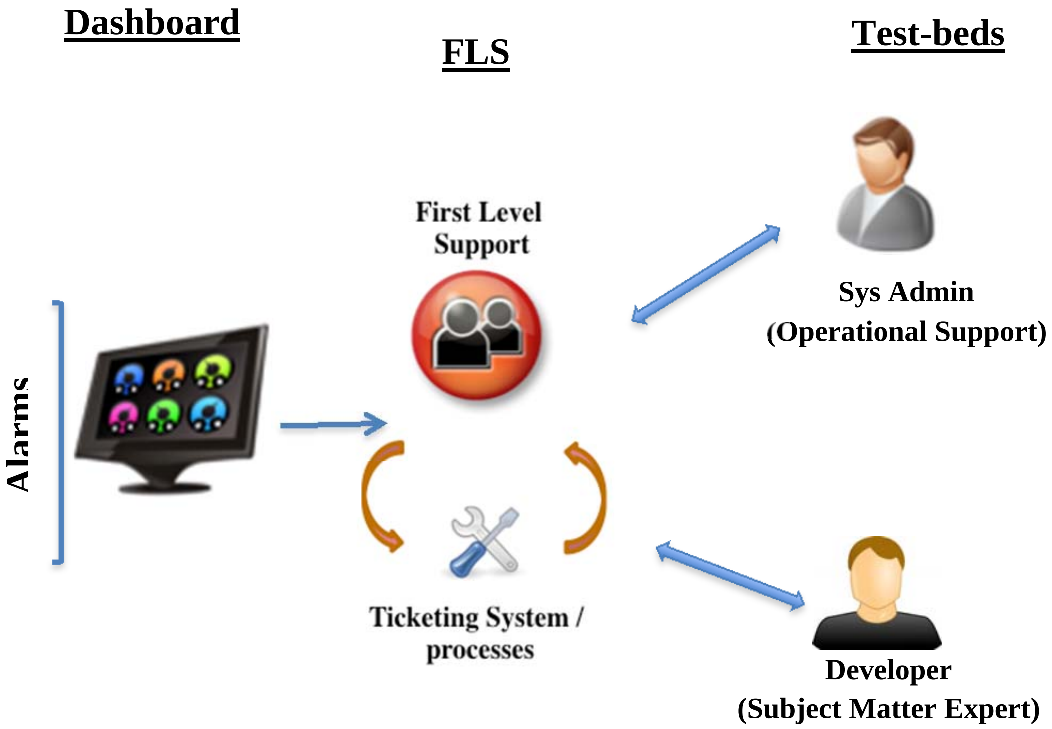


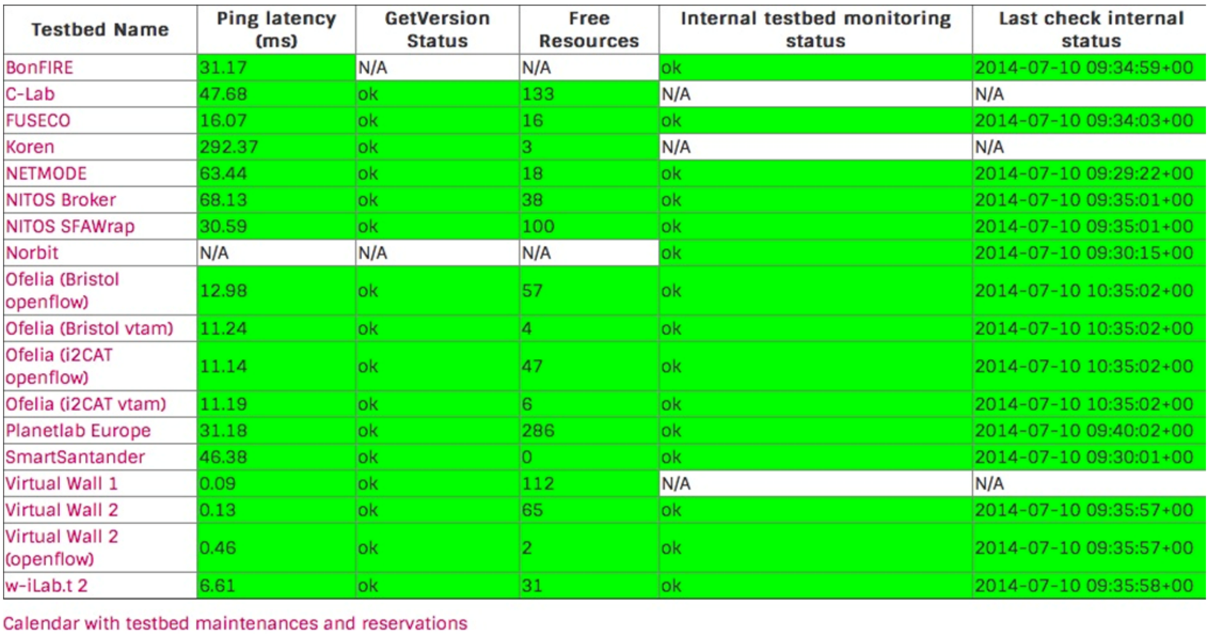
Figure 1. Schematic Diagram of First Level Support

It shows the central ticketing system and processes operated by DANTE and the interactions between FLS and the test-bed systems staff and developers. Importantly, it also illustrates the role of the dashboard developed in response to the initial requirements specified in deliverable D8-1. A key component of FLS, the dashboard monitors and summarises the alarm states of all the Fed4FIRE test-beds and presents them as a visual display to the FLS operators. Figure 2 below illustrates the current implementation of the display.

The basic requirement of the monitoring dashboard was that is should push a summary of the operational status of a test-bed using a RAG (Red, Amber, Green) indication. This summary should be based upon the monitoring of key components of each test-bed that indicate the overall availability status of the test-bed to the dashboard. FLS operators monitor the dashboard and take action in the case of exception conditions being displayed. The key components monitored have been standardised across all test-beds to the extent possible.

To a significant extent the initial dashboard implementation has fulfilled the original requirements of FLS. For each test-bed it presents the following information, together with an indication of the time of the most recent check.

- An indication of Network reachability based on a ping test
- The result of a 'Get Version' call to the test-bed Aggregate Manager
- An indication of whether the test-bed has Free resources
- An integration of test-bed specific alarm conditions into a single status indicator



Testbed Name	Ping latency (ms)	GetVersion Status	Free Resources	Internal testbed monitoring status	Last check internal status
BonFIRE	31.17	N/A	N/A	ok	2014-07-10 09:34:59+00
C-Lab	47.68	ok	133	N/A	N/A
FUSECO	16.07	ok	16	ok	2014-07-10 09:34:03+00
Koren	292.37	ok	3	N/A	N/A
NETMODE	63.44	ok	18	ok	2014-07-10 09:29:22+00
NITOS Broker	68.13	ok	38	ok	2014-07-10 09:35:01+00
NITOS SFAWrap	30.59	ok	100	ok	2014-07-10 09:35:01+00
Norbit	N/A	N/A	N/A	ok	2014-07-10 09:30:15+00
Ofelia (Bristol openflow)	12.98	ok	57	ok	2014-07-10 10:35:02+00
Ofelia (Bristol vtam)	11.24	ok	4	ok	2014-07-10 10:35:02+00
Ofelia (i2CAT openflow)	11.14	ok	47	ok	2014-07-10 10:35:02+00
Ofelia (i2CAT vtam)	11.19	ok	6	ok	2014-07-10 10:35:02+00
Planetlab Europe	31.18	ok	286	ok	2014-07-10 09:40:02+00
SmartSantander	46.38	ok	0	ok	2014-07-10 09:30:01+00
Virtual Wall 1	0.09	ok	112	N/A	N/A
Virtual Wall 2	0.13	ok	65	ok	2014-07-10 09:35:57+00
Virtual Wall 2 (openflow)	0.46	ok	2	ok	2014-07-10 09:35:57+00
w-iLab.t 2	6.61	ok	31	ok	2014-07-10 09:35:58+00

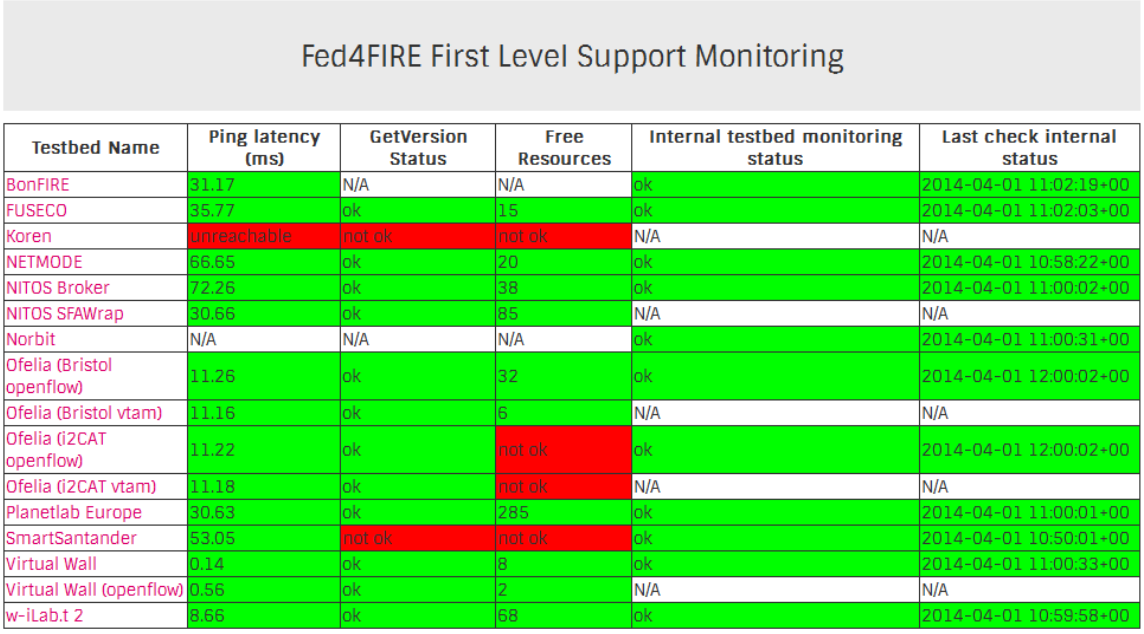
Calendar with testbed maintenances and reservations

Figure 2. Screenshot of the current dashboard implementation.

1.1 Operational Experience and Issues

Practical experience of using the dashboard has indicated a number of areas where its functionality, based on the initial requirements, can be improved. The dashboard display requires a FLS operator to notice changes and institute an appropriate fault resolution process. If all the test-beds are functioning normally, the dashboard is 'green.' A test-bed fault will cause one or more fields to become red. The dashboard has no 'memory' and if, when it is refreshed, the fault has cleared the dashboard will again become green. The operator has a very limited time window to detect this. Thus, there is a significant risk that transient faults will not be detected.

A second issue relates to the case where there are a number of test-bed faults. In this case the dashboard will have multiple red cells. Figure 3 below illustrates this state. If a further fault occurs and, as a result, a field adjacent to an existing 'red field' also becomes red, it can be very difficult for an operator to detect the change in the dashboard. There is therefore a risk that an additional fault condition will be missed.



Fed4FIRE First Level Support Monitoring

Testbed Name	Ping latency (ms)	GetVersion Status	Free Resources	Internal testbed monitoring status	Last check internal status
BonFIRE	31.17	N/A	N/A	ok	2014-04-01 11:02:19+00
FUSECO	35.77	ok	15	ok	2014-04-01 11:02:03+00
Koren	unreachable	not ok	not ok	N/A	N/A
NETMODE	66.65	ok	20	ok	2014-04-01 10:58:22+00
NITOS Broker	72.26	ok	38	ok	2014-04-01 11:00:02+00
NITOS SFAWrap	30.66	ok	85	N/A	N/A
Norbit	N/A	N/A	N/A	ok	2014-04-01 11:00:31+00
Ofelia (Bristol openflow)	11.26	ok	32	ok	2014-04-01 12:00:02+00
Ofelia (Bristol vtam)	11.16	ok	6	N/A	N/A
Ofelia (i2CAT openflow)	11.22	ok	not ok	ok	2014-04-01 12:00:02+00
Ofelia (i2CAT vtam)	11.18	ok	not ok	N/A	N/A
Planetlab Europe	30.63	ok	285	ok	2014-04-01 11:00:01+00
SmartSantander	53.05	not ok	not ok	ok	2014-04-01 10:50:01+00
Virtual Wall	0.14	ok	8	ok	2014-04-01 11:00:33+00
Virtual Wall (openflow)	0.56	ok	2	N/A	N/A
w-iLab.t 2	8.66	ok	68	ok	2014-04-01 10:59:58+00

Figure 3. Dashboard showing multiple faults.

To avoid these cases a number of improvements to the dashboard have already been requested from the developer, iMinds. Specifically the dashboard should provide an additional indication when there is a critical alarm (red cell) generated by a test-bed. Three possibilities have been identified to achieve this.

i. Generating an audible dashboard alarm when a critical alarm has been detected

ii. Generating an e-mail alert to FLS when a critical alarm has been detected.

iii. Generating a persistent visible element on the dashboard which registers an alarm and latches until it is reset by an FLS operator.

Some of these changes have already been implemented. Early experience of them suggests that they are helpful. It is apparent, already, that there is a need to also provide an e-mail alert when a critical alarm is cleared. Data collected since the changes were made is currently being analysed and a revised implementation of the original concept is expected shortly.

1.2 Experimenters list

The original concept of FLS envisaged that experimenters encountering issues would contact FLS. In practice, at this stage of the project, the FLS operators do not have sufficient detailed experience to add significant value here. There are limited project resources available for the implementation of FLS. In order to deal with experimenters' issues it has been decided to provide direct contact between experimenters and developers/test-bed operators via an e-mail list. An experimenters' list has, therefore, been established. The list, which is hosted on Google groups, enables experimenters to post questions to a range of experts.

In order to learn from this process and to better understand the type of problems that are raised, FLS analyses the activity on the experimenters' list. The analysis is based on a set of standard categories namely

i. Experimental Issue: An issue arising as a result of carrying out an experiment.
ii. General Query about capabilities: A query about the facilities provided by a test-bed unrelated to a specific running experiment.
iii. Informational: A statement of about capabilities not made in response to an individual query.
iv. Interaction between Test-beds: Issues relating to linking test-beds in an experiment.
v. Network Connectivity: Issues relating to network connectivity as part of an experiment.

Table 1 below shows the analysis for the month of September 2014. Table 2, underneath it, provides a summary of issues by type of issue and by test-bed/technology for the period of operation of the experimenters' list. It should be noted that some of the issues raised relate to a technology e.g. jFED rather than a particular test-bed.

Date	Query/Test-Bed(s)	Question Type	Detail	Comment
16-Sep-14	W-Ilabt	Experimental Issue	Mobile Node reboot	Unintended reboot
17-Sep-14	Bonfire	Experimental Issue	Elasticity service in bonfire	Operational Issues with elasticity service.
20-Sep-14	W-Ilabt	Experimental Issue	Mobile Node deadlocked	Intermittent issue
23-Sep-14	W-Ilabt	Experimental Issue	Robot Control failure	Reset
23-Sep-14	W-Ilabt	Experimental Issue	Robot Control failure	Debugged
24-Sep-14	jFED	General Query about capabilities	Establish network connection	GÉANT VLAN transition
24-Sep-14	jFED	Experimental Issue	Slice Sharing	
24-Sep-14	jFED	Experimental Issue	Network Connection issue	
29-Sep-14	jFED	Experimental Issue	Network Connection issue	Addressing - VLAN, Port and IP issues
29-Sep-14	Virtual Wall	Experimental Issue	Unable to create VM's	Potential bug

Table 1 Summary of Experimenters' list activity September 2014

Table 2: Aggregate analysis of Experimenters' list (January-September 2014)

Query/Test-bed(s)	Experimental Issue	General Query about capabilities	Informational	Interaction between test-beds	Network Connectivity	Grand Total
Bonfire	14	19				33
Bonfire, Amazon				1		1
Emulab Log in	1					1
Experiment	2					2
ilab.t	5	1				6
INRIA	5	2	3			10
jFED		1				1
Multiple	2					2
NEPI		2				2
Perform LTE		1				1
PlanetLab	4	4				8
Virtual Wall	6	9	1		1	17
Virtual Wall, Bonfire	2	9		1	3	15
W-Ilabt	7	4	1			12
Grand Total	48	52	5	2	4	111

2 New Requirements

2.1 Process Automation

Currently, FLS resolution processes are initiated by an FLS operator observing a change in dashboard status and creating an appropriate trouble ticket. This approach has the merit that each ticket creation is analysed by an experienced operator. However, as noted in Section 1, the existing dashboard design can potentially lead to missed problems. It is also the case that most of the ticket creation process could be automated. This would still permit operator inspection but, by automating the process, the manual aspects of dashboard observation and ticket creation, which add no significant value, could be eliminated.

Two developments would be necessary to automate this process. Firstly a standardized approach to the definition of significant events is needed. An operator will exercise judgment as to what category an event belongs to. This needs to be reflected in a set of rules which would categorise events automatically. Secondly, in order to process events consistently, a common vocabulary to describe such events and also the context in which they occur (time, location, operational state etc.) is required. There is a general open standard for network management which could be applied here, Simple Network Management Protocol (SNMP).[1] Since SNMP is widely used in management of distributed ICT systems it is well understood and integrates well with existing tools employed by FLS.

It is therefore recommended to consider the automation of FLS incident detection using SNMP, which offers a standardized and open approach to managing devices. It includes the concept of an SNMP trap. An SNMP trap would allow a test-bed element to implement a ‘push approach’ to communicate exception conditions to FLS. Implementing an appropriate set of SNMP traps within the test-beds of the federation would permit a significantly higher level of automation for FLS, making it more efficient and improving operational quality.

Automation of the initiation of FLS processes will require additional elements of technical development. In order to achieve automation there is a need for a standardised operational vocabulary as well as an agreed set of rules that are applied consistently by all test-beds for the creation of SNMP traps. The SNMP standard includes the concept of Management Information Base (MIB) which has associated with it a standard syntax that may be an appropriate starting point.

Requirement 1: Provide an SNMP trap capability to automate the creation of FLS trouble tickets
Requirement 2: Develop and implement a standardised operational vocabulary to allow the automation of elements of FLS.

[1] SNMP is defined in RFC 1157

2.2 Network Testing

The current approach to test-bed reachability testing, associated with fed4FIRE, is based on using a ping test to determine the network reachability of a test-bed. This is reported as a ping latency figure in the dashboard. The actual latency is not of huge significance. Changes to it might be considered relevant but this is not tracked. Assuming that the federation only uses public Internet connectivity for interconnecting test-beds in the federation, this approach represents a reasonable proxy for connectivity testing. Recently, a more sophisticated approach to the network interconnection of some of the federated test-beds has been introduced. This is based on the use of VLAN's, configured over dedicated capacity configured between the test-beds, as well as the use of the GÉANT Autobahn service. Autobahn is a Bandwidth on Demand (BoD) service offered by GÉANT, which enables users to request dedicated capacity only when it is required.

This semi-dedicated connectivity raises new challenges in terms of test-bed reachability testing. The current approach to reachability, based on ping testing from a central testing point, located at iMinds in Gent, only provides a general indication of test-bed reachability. It is not capable of monitoring the availability or the performance of the semi-dedicated connectivity. Some of the necessary information needed to monitor semi-dedicated connectivity can be derived, indirectly, from trouble tickets related to the connectivity. This is, however, a reactive approach. It is not part of the federation monitoring and it will not allow FLS to deal with problems related to this connectivity.

Requirement 3: Develop a mechanism for monitoring semi-dedicated connectivity, which is part of the federation, and integrate this information into the FLS dashboard.

2.3 Enhanced Reporting

The dashboard provides a summary, quasi real-time, view of the status of the test-beds which are part of the Fed4FIRE federation. The FLS activity, derived from the dashboard state and captured in the Trouble Ticket System (TTS), provides some basis for statistical analysis of the performance of Fed4FIRE. This activity is reported in a monthly report, which also includes trend analysis (An example of such a report is attached at Appendix A). This approach to reporting can be described as 'supply led.' The main issue with it is that it is not at all related to experimenters' usage of the federation. Operational support and service performance analysis should ideally be targeted at the service as experienced by users (demand led). There is, therefore, an unfulfilled need to relate the federation performance as monitored by FLS with the performance as experienced by experimenters.

In order to do this, it is important that Fed4FIRE has available a live database of experiments using the federation. Without such a database, it is not possible for FLS to correlate detected incidents with running experiments and inform and assist experimenters in case of problems. The database will also improve the reporting of the federation. Currently, FLS reporting consists of a monthly report summarizing activity together with an analysis of the experimenters' list issues. There is, however, no correlation between the operational reports produced by FLS and experimenters' usage of the federation. A real-time database of live experiments would enable the creation of operational reports much more relevant to federation users.

Requirement 4: Create a database of live experiments using the federation to enable FLS to correlate issues detected with experimenters' activity and improve the operational reporting of the federation.
Requirement 5: Develop reporting to include a demand led approach to federation performance.

2.4 Pervasive Comment Capability on Dashboard.

In order to provide extended hours coverage and to ensure continuity of service, FLS is provided by a team of operators. Thus, a single incident will be handled, typically, by several people. Although the TTS provides a formal repository for information relating to incidents, the dashboard is the principal tool used by FLS operators. As noted above the dashboard refreshes regularly, and previous information is overwritten. There is a need to have a comment capability associated with the dashboard to allow operators to exchange informal comments associated with the status of a test-bed. These include points such as hand-over notes, informal observations etc. They are essentially of a semi-transitory nature. Whilst is would be possible to use the TTS for this function, it is designed to provide a formal, process-driven record of operational activity. The dashboard is the principle shared tool for FLS operators. It is proposed that the dashboard be enhanced to provide a pervasive comment capable with write access for FLS operators and read access for others. It needs to be pervasive to prevent it being refreshed every time the dashboard is updated.

Requirement 6: Provide an additional dashboard field per test-bed to allow FLS operators to comment on activity related to a test-bed.

3 Conclusions

The original requirements document from WP8.1 led to the development of a monitoring dashboard that, to a significant extent, has fulfilled the initial requirements. Experience of using this dashboard has already given rise to requests for improvements to its functionality to better meet the original needs. These improvements are in the course of implementation.

In addition, this deliverable recognises a number of new functions that should be added to enhance the operational capabilities of the Fed4FIRE federation. These cover a range of new capabilities including improvements to assist in the automation of elements of the FLS process, development of the network testing capability to recognise the enhanced connectivity options available to experimenters and improvements to the reporting capability to make it more relevant to experimenters. In addition one new function is proposed in relation to the existing dashboard to improve its capability from an FLS operators perspective.