

License Management

DESCRIPTION

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Contents

1	Introduction	1
1.1	IPWorks Application License Management Framework	1
1.2	IPWorks License Handling Overview	2
2	Functions and Concepts	3
2.1	IPWorks Licenses	3
2.2	Modes of Operation	5
2.3	Types of Operation	9
2.4	License Expiration	10
2.5	Future Dated Licenses	10
2.6	Soft Locking	10
2.7	Hard Locking	11
3	Managed Object Model	13
4	Configuration Management	15
5	Fault Management	17
6	Appendix	19
6.1	Fingerprint	19





1 Introduction

This document provides an overview of the management model and concepts associated with the License Management (LM) managed area.

A managed area is represented by a group of Managed Object Classes (MOCs) within the Managed Object Model (MOM).

1.1 IPWorks Application License Management Framework

Figure 1 illustrates the IPWorks application License Management (LM) framework.

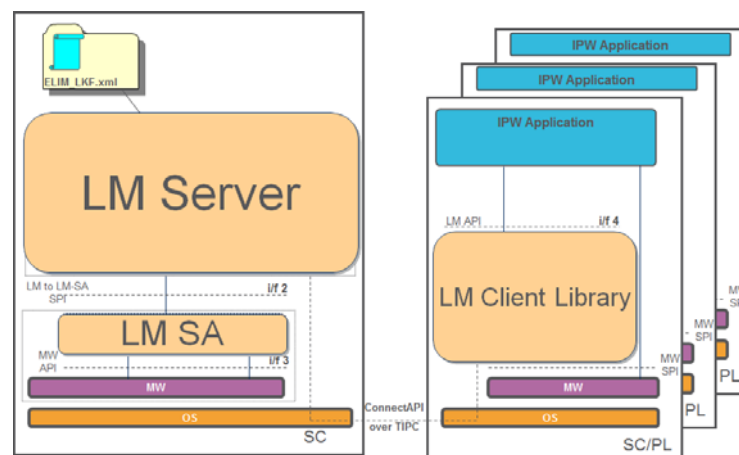


Figure 1 Overview of IPWorks LM Framework

Where:

— LM Server:

- LM Server implements the functionality of license manager. It maintains a global cache containing license use information and monitors the status of the licenses and interacts with the ELIM.
- Active-Standby on System Controllers.

— LM Client Library

- LM Client Library presents the license manager API.
- The LM Client has a local cache containing license use information in order to allow fast access to that for the application requests and to minimize traffic.
- The request is forwarded to the LM Server in case it cannot be fulfilled by the local cache.



1.2 IPWorks License Handling Overview

The LM Server and LM Client work together in the cluster level. The LM Servers are on the System Controller (SC) boards, each LM Client is on SC or Payload (PL) board.

The LM Server collects the License information from the LM Client, when the License related issue occurs, LM Server raises the corresponding alarm in the view of cluster level.

For IPWorks services, each service has its own local LM client.

Figure 2 illustrates the LM Server for IPWorks.

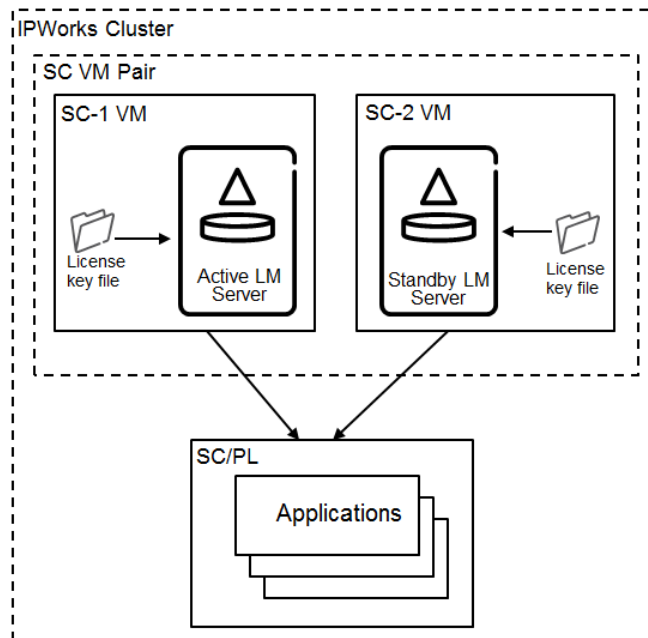


Figure 2 License Management Server



2 Functions and Concepts

LM provides a management interface for the Managed Element (ME) license keys.

License keys grant the use of purchased functionality or capacity. License keys are ordered from the Ericsson software supply organization and are delivered as license key files.

The IPWorks licenses have the following categories:

- Feature licenses

Control access to the optional features in a managed function.

- Capacity licenses

Control the number of licensed objects that can be active or used at the same time.

- Throughput capacity licenses

Control the rate that licensed objects can be used.

2.1 IPWorks Licenses

The IPWorks licenses, listed in Table 1, are developed for different features. When the customer orders the features, the associated licenses are ordered as well.

Table 1 IPWorks Feature Licenses

Feature Name	License Management Aspect	License Type	Quantity	Description	Associated Applications
FAT 102 3219/1	Internet DNS Feature	Feature	1	The license is for validating the Internet DNS Feature of the DNS Server. Only when internet DNS feature is activated, the feature license will take effect, and the capacity of DNS server will not be limited by the capacity license "FAT 102 3219/4".	DNS Server



Table 1 IPWorks Feature Licenses

Feature Name	License Management Aspect	License Type	Quantity	Description	Associated Applications
FAT 102 3219/4	DNS Base Package QPS	Throughput Capacity ⁽¹⁾	N (N QPS)	The license is for the maximum QPS of DNS server. When the DNS traffic exceeds the license capacity limit, DNS behavior is as soft locking. For more information about the soft locking, see Section 2.6 Soft Locking on page 10.	DNS Server
FAT 102 3219/5	IMS Interconnect Feature	Feature	1	The license is for validating the IMS Interconnect Feature of the ENUM Server.	ENUM Server
FAT 102 3219/6	AAA Base - Classic Session Capacity	Capacity	N	The license indicates the maximum number of AAA sessions when AAA Server is deployed in classic architecture.	AAA Server
FAT 102 3219/7	AAA Base - Layered Session Capacity	Capacity	N	The license indicates the maximum number of AAA sessions when AAA Server is deployed in data-layered architecture.	AAA Server
FAT 102 3219/8	PKI authentication Support Feature	Feature	1	The license is for validating the PKI authentication Support Feature of the AAA Server.	AAA Server (DIAMETER)
FAT 102 3219/9	WiFi Mobility Management Feature	Feature	1	The license is for validating the WiFi Mobility Support Feature of the AAA Server.	AAA Server (DIAMETER)
FAT 102 3219/10	Geographic Redundancy Feature	Feature	1	The license is for geographical redundancy providing protection against disaster situations such as fire or earthquakes and reducing non-availability caused by outages.	Storage Server



Table 1 IPWorks Feature Licenses

Feature Name	License Management Aspect	License Type	Quantity	Description	Associated Applications
FAT 102 3219/1 1	DHCP Base Package TPS	Throughput Capacity ⁽¹⁾	N (N TPS)	<p>The license is for the maximum TPS of DHCP server.</p> <p>When the DHCP traffic exceeds the license capacity limit, DHCP behavior is as soft locking. For more information about the soft locking, see Section 2.6 Soft Locking on page 10.</p>	DHCP Server
FAT 102 3219/1 2	ENUM Base - Classic TPS	Capacity	N (N TPS)	<p>The license is for the maximum TPS of ENUM query from the clients.</p> <p>When the ENUM traffic exceeds the license capacity limit, ENUM behavior is as soft locking. For more information about the soft locking, see Section 2.6 Soft Locking on page 10.</p>	ENUM Server
FAT 102 3219/1 3	ENUM Base - Layered TPS	Capacity	N (N TPS)	<p>The license is for the maximum TPS of ENUM front end query from the clients.</p> <p>When the ENUM traffic exceeds the license capacity limit, ENUM behavior is as soft locking. For more information about the soft locking, see Section 2.6 Soft Locking on page 10.</p>	ENUM Server

(1) The license is implemented as capacity license, though it's a throughput capacity license in concept.

2.2 Modes of Operation

IPWorks LM component operates in the following modes:

- Integration Unlock mode



- Normal mode
- Autonomous mode
- Locked mode
- Unknown mode

2.2.1 Integration Unlock Mode

LM runs in Integration Unlock mode after installation. While in this mode, LM can function without access to official licenses. This mode allows use of the system when access to a valid license key file is unavailable.

LM automatically transitions to Normal mode when the Integration Unlock window has expired, recorded by attribute `expiration`. Any license that was used during Integration Unlock mode for which no valid license key was found expires.

2.2.2 Normal Mode

Normal mode is the default operational state of LM. During normal operation, the system authorizes only those feature sets and capacity levels that have a valid license from a license key file.

From Normal mode, LM can transition to other modes, as shown in Figure 3.

2.2.3 Autonomous Mode

LM automatically transitions from Normal mode to Autonomous mode when any installed license key file becomes unavailable. IPWorks raises the alarm `License Management, Autonomous Mode Activated` to indicate this mode. During Autonomous mode, licenses that are already reserved by the client application continue to function normally; These unreserved licenses cannot be used until access to the missing file is restored, or a replacement license key file is loaded.

LM can function in Autonomous mode for a maximum of 24 hours. If the license key file cannot be re-established within the 24 hour window, LM enters Locked mode.

While operating in Autonomous mode, LM tries to access the license key files at regular intervals. As soon as LM can access all of the installed license key files it automatically reverts to Normal mode.

LM does not transition into Autonomous mode if a license key file has never been installed.

During Autonomous mode, the application with the cached license can still work until the cached license becomes unavailable (for example, due to the application service restart). However, for the service controlled by the uncached license, all



requests will be rejected. For example, during Autonomous mode, the provision on Storage Server will not be rejected, because the Storage Server uses the local cached license to handle the provision. After the Storage Server is restarted, the cached license on Storage Server becomes unavailable, then all the provision request will be rejected.

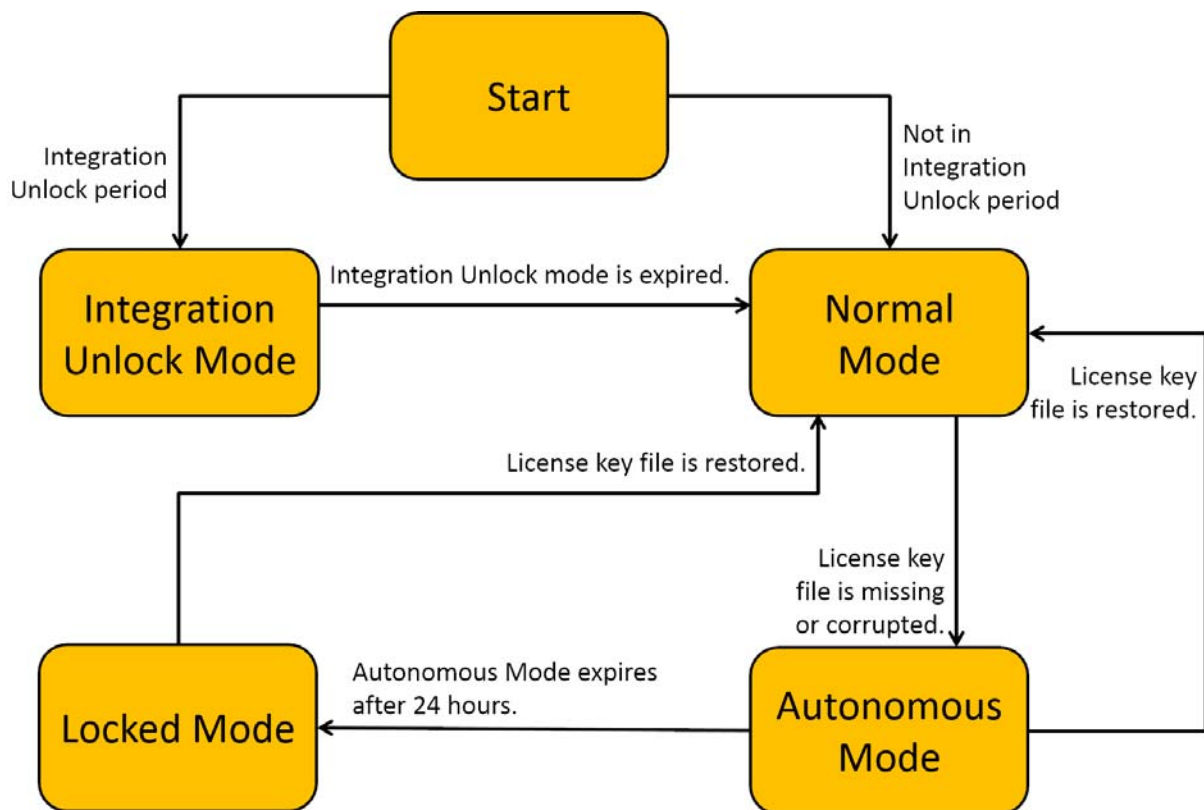


Figure 3 License Management State Transitions

2.2.4 Locked Mode

LM transitions from Autonomous mode to Locked mode if valid license key files are not available by the end of the 24-hour Autonomous mode window. IPWorks raises the alarm License Management, Key File Fault to indicate this mode.

During Locked mode, the application with the cached license can still work until the cached license becomes unavailable (for example, due to the application service restart). LM attempts to access the license key files at regular intervals. As soon as all of the installed license key files are detected, LM automatically reverts to Normal mode.



2.2.5 Unknown Mode

When the License Manager Client is unable to contact the License Manager Server, it reports its operational mode as Unknown Mode. This operational mode applies for the LmClient only.

During Unknown mode, the application with the cached license can still work until the cached license becomes unavailable (for example, due to the application service restart).

2.2.6 IPWorks License in LM Mode

This section provides information about the IPWorks licenses in each License Management mode.

Note: The license supported by the Soft Locking (such as DNS QPS) still works when it exceeds the capacity limit.

Table 2 ENUM Base - Classic Record / ENUM Base - Layered Record

Mode	Capacity Limit
NORMAL	If LM Client receives a valid license from LM Server, the capacity limit is defined in installed LKF. Otherwise, the capacity limit is 0.
INTEGRATION UNLOCK	If LM Client receives a valid license from LM Server, the capacity limit is defined in installed LKF. Otherwise, the capacity limit is $2^{63}-1$.
AUTONOMOUS	When cached license is valid, the capacity limit is defined in the previously loaded LKF. Otherwise, the capacity limit is 0.
LOCK	The capacity limit is 0.

Table 3 DNS and DHCP Base Package QPS / AAA Base - Classic Session Capacity/ AAA Base - Layered Session Capacity

Mode	Capacity Limit
NORMAL	If LM Client receives a valid license from LM Server, the capacity limit is defined in installed LKF. Otherwise, the capacity limit is 0.
INTEGRATION UNLOCK	If LM Client receives a valid license from LM Server, the capacity limit is defined in installed LKF. Otherwise, the capacity limit is 30.
AUTONOMOUS	When cached license is valid, the capacity limit is defined in the previously loaded LKF. Otherwise, the capacity limit is 0.
LOCK	When the cached license is valid, the capacity limit is 30. Otherwise, the capacity limit is 0.

Table 4 IMS Interconnect Feature (Enabled/Disabled)

Mode	Behavior
NORMAL	The feature is enabled only when DNS/ENUM server can receive a valid license from LM server, otherwise disabled.
INTEGRATION UNLOCK	Enabled



Table 4 IMS Interconnect Feature (Enabled/Disabled)

Mode	Behavior
AUTONOMOUS	The feature is enabled if cached license is valid, otherwise disabled.
	Specifically, if the DNS/ENUM Server restarts in this mode, the feature is disabled because there is no valid cached license.
LOCK	Disabled

Table 5 PKI Authentication Support Feature (Enabled/Disabled) / WiFi Mobility Support Feature (Enabled/Disabled)

Mode	Behavior
NORMAL	The feature is enabled only when AAA server (DIAMETER) can receive a valid license from LM server, otherwise disabled.
INTEGRATION UNLOCK	Enabled
AUTONOMOUS	The feature is enabled if cached license is valid, otherwise disabled.
	Specifically, if the AAA server (DIAMETER) restarts in this mode, the feature is disabled because there is no valid cached license.
LOCK	Disabled

2.3 Types of Operation

LM supports the following operations:

- Installation of license key files

Once received from ELIS, a license key file must be installed before it can be used. The procedure in [Install License Key File](#) provides further details on how to perform this operation.

- Update of license information

The information about the available licenses and their use is published to the Management Information Base (MIB) and is automatically updated every 30 minutes. The procedure in [View License Information](#) provides further details on how to perform this operation.

However, after a license key file has been installed, it is recommended to ensure that the latest information is reflected in the MIB. It is done by triggering an immediate update of the license information. The procedure in [Update License Information](#) provides further details on how to perform this operation.

- View license information

Before ordering a new license key, the user can verify the fingerprint value on IPWorks to ensure that the correct information is provided in the order request.



The user can check the list of license keys available on IPWorks and their validity information for preventive maintenance purpose and in the problem resolution situations. The procedure in [View License Information](#) provides further details on how to perform this operation.

2.4 License Expiration

All licenses have an expiry date except for the perpetual license keys. The expiration date specified by the `FeatureKey.expiration` and `CapacityKey.expiration` attributes.

The expiration date for all fetched licenses is cached and monitored by the License Manager. When a cached license enters the advanced warning period defined by the `Lm.licenseExpirationWarning` parameter, a minor `License Management, License Key Not Available` alarm is raised to the operator. When the expiration date is reached, the severity of the associated `License Management, License Key Not Available` alarm is raised to major and all affected application instances are notified that the license has expired. An expired license remains in the license cache until it has been released by all application instances. `License Management, License Key Not Available` stays on the Active Alarm List until an updated license key file has been installed, replacing the expired license, or the expired license is released from the license cache.

2.5 Future Dated Licenses

All licenses are valid from a start date specified by the `FeatureKey.validFrom` and `CapacityKey.validFrom` attributes.

If a requested license is present in the license key file, but will only become valid in the future, LM caches the license information and notifies the application that a future dated license is available. The cached license continues to be monitored by LM. If the license is still present in the cache when it becomes valid, LM will inform the application that the requested license can now be used.

2.6 Soft Locking

During the business rush hour, when the traffic exceeds the service license limit (such as the maximum QPS) or the configured thresholds, IPWorks does not reject new service requests. Meanwhile, a corresponding alarm `License Management, Capacity Usage Threshold Reached` is raised to remind the operators to check the reasons of the unexpected high QPS. Then the operators need to implement proper actions to clear the alarm, such as applying for service extension, troubleshooting the network defects, and so on. For information on how to clear the alarm, refer to `License Management, Capacity Usage Threshold Reached`.

IPWorks applies the Soft Locking for the following licenses:

- DNS Base Package QPS License



- ENUM Base - Classic TPS license
- ENUM Base - Layered TPS license
- AAA Base - Classic Session Capacity License
- AAA Base - Layered Session Capacity License
- DHCP Base Package TPS License

2.7 Hard Locking

When the traffic exceeds the configured thresholds, a corresponding alarm `License Management, Capacity Usage Threshold Reached` is raised. When the traffic exceeds the service license limit, IPWorks rejects the new service requests.

IPWorks applies the Hard Locking for the following license:

- ENUM Base - Classic Record License





3 Managed Object Model

The LM managed area is represented in the Managed Object Model (MOM) as follows:

```
ManagedElement
+-SystemFunctions
+-Lm
+-AutonomousMode
+-CapacityKey
+-EmergencyUnlock
+-FeatureKey
+-IntegrationUnlock
+-KeyFileManagement
+-KeyFileInformation
```

For general information about the MOM, MOCs, Managed Objects (MOs), cardinality, and related concepts, refer to [Managed Object Model User Guide](#).

The LM MOCs are described in Table 6.

Table 6 License Management Managed Object Class Descriptions

Managed Object Class	Description
Lm	The root of the LM model, supports activities and describes information related to LM.
AutonomousMode	Describes the Autonomous Mode state.
CapacityKey	Describes the available capacity license and throughput capacity license keys.
EmergencyUnlock	Handles Emergency Unlock, activation/deactivation, and describes the Emergency Unlock state.
FeatureKey	Describes the available feature license keys.
IntegrationUnlock	Describes the Integration Unlock state.
KeyFileManagement	Handles installation of key files.
KeyFileInformation	Describes the installed key files.





4 Configuration Management

LM is accessed using NETCONF or the Ericsson Command-Line Interface (ECLI) to manipulate the MIB.

The following operations can be performed by the user and are described in Operating Instructions using the ECLI:

Manage Installation

- Install License Key File

Manage License Information

- Update License Information
- View License Information





5 Fault Management

The LM alarms are described in Table 7.

Table 7 License Management Alarms

Alarm	Description
License Management, Autonomous Mode Activated	Raised in Autonomous mode after an installed license key file is missing or becomes corrupted.
License Management, Capacity Usage Threshold Reached	Applies to capacity and throughput capacity licenses. Raised with severity WARNING if <code>grantedCapacityLevel</code> for a given capacity license exceeds the alarm threshold set by attribute <code>capacityAlarmThreshold</code> , but is still below <code>licensedCapacityLimit</code> . If the reservation level reaches <code>licensedCapacityLimit</code> , the severity increases to MAJOR.
License Management, Key File Fault	Raised in Locked mode when the license key file used by LM is unavailable. A missing license key file prevents IPWorks from using licensed features and functionality.
License Management, License Key Not Available	Raised in Normal mode with severity warning when a license key enters the expiration warning period before it expires. When the expiry date is reached, the severity is raised to major.





6 Appendix

6.1 Fingerprint

A license key is locked to IPWorks based on a fingerprint. The fingerprint is generated at IPWorks installation time and can no longer be changed. The operator uses the fingerprint to order the license key file through ELIS, and install the license key file with permitted features and capacities on IPWorks.

The fingerprint format is defined as follows:

`<UUID>-<Host Name>-<O&M IP address>`

Where:

- `<UUID>` must be fixed to 36 characters (32 characters and 4 hyphens inside).
- `<Host Name>` can be any character, and maximum length is 256 characters.
- `<O&M IP address>` can have a maximum length of 15 characters (4*3 chars + 3 underlines).

For example, 998652C4-8F4F-4996-9EBF-D1908ACECD6C-SC-1-169_254_44_11

Where:

- 998652C4-8F4F-4996-9EBF-D1908ACECD6C is the UUID.
- SC-1 is the Host Name.
- 169_254_44_11 is the O&M IP address.