Flexible API SStandard for E-content NISO (FASTEN)

A Recommended Practice of the National Information Standards Organization

Available for Public Comment:
October 31 – November 30, 2019
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Published by
National Information Standards Organization (NISO)
3200 Clipper Mill Road, Suite 302
Baltimore, MD 21211
www.niso.org

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ISBN (13): to be added at publication
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Foreword

About this Recommended Practice

This Recommended Practice is intended to modernize library-vendor technical interoperability using RESTful web service APIs to fulfill community, vendor, and developer requirements in transmitting library-related information related to serving licensed electronic content. The scope includes areas such as login/authentication, account information, availability, status, check-out, audio/video/online streaming, patron registration with vendor(s).

By establishing standards using RESTful Web services APIs, the library industry will leave many archaic, difficult-to-use toolsets behind, and allow libraries more flexibility in meeting local needs.

NISO Information Discovery & Interchange Topic Committee Members

The NISO Information Discovery & Interchange Topic Committee had the following members at the time it approved this Recommended Practice:

[to be added by NISO after approval]

Flexible API STandard for E-content NISO (FASTEN) Working Group Members

The following individuals served on the Flexible API STandard for E-content NISO (FASTEN) Working Group, which developed and approved this Recommended Practice:

Michael Blackwell
St. Mary's County Library

Nathan Peterson
SirsiDynix

Christopher Carvey (co-chair)
Queens Library

Jane Plass
RAILS: Reaching Across Illinois Library System

Xan Charbonnet
Biblionix

Joe Schulkins
EBSCO Information Services

Matthew Dovey
Ceridwen Ltd.

Jan Waterhouse
University at Albany Libraries

Jeremy Nelson
Stanford University

Josh Weisman (co-chair)
Ex Libris Ltd.

Christine Peterson
Amigos Library Services

Acknowledgements

The Flexible API STandard for E-content NISO (FASTEN) Working Group wishes to acknowledge those outside the formal working group membership who contributed to this effort; the following
people, former working group members, all made substantive contributions in various ways through the life of the project:

Livia Bitner, Baker and Taylor; Stephen Grubb, Broward County Library; Marc Keeper, EBSCO Information Services; Nassib Nassar, Index Data; Michael Porter, Maricopa County Library District; Rachel Vacek, University of Michigan Library; Kelvin Watson, Broward County Library.

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Section 1: Introduction

1.1 Purpose and Scope

Since 2010, when library e-book circulation began to grow substantially, much progress has been made in the digital reading experience. The process to find and read a text, which once required as many as eighteen steps, has been improved. Technological solutions, especially the adoption of Application Programming Interfaces (APIs), do seemingly-hidden work to streamline finding and reading. Nevertheless, barriers to a truly seamless content experience still exist—barriers which are likely to loom ever larger as other library digital content formats, such as audio and video, grow more popular. One of the biggest barriers for library digital patrons is navigating between the many content platforms libraries must offer to ensure a depth and variety of digital content. Having to create an account for two, or three, or more vendors creates a confusing and fragmented experience. Users may opt for one platform only, so that unique content from other sources is simply never discovered. Libraries should offer all their digital content in one easy-to-use, integrated, and comprehensive platform—a platform that can be accessed and operated by the devices most commonly used by library patrons. Otherwise, libraries will be left behind by commercial solutions that set high standards for dynamic, flexible, and responsive features.

In June 2016, NISO proposed a working group to develop standards that would allow this vision to become a reality. The group, FASTEN (Flexible API STandard for E-content NISO), has built upon work from the Queens Library in New York City, which itself involved a worldwide conversation and resulted in a pioneering API definition that integrated many vendor platforms. The hope is to replace aging, inflexible, and hard-to-use enterprise tools, which deploy disparate protocols such as SIP, SIP2, proprietary interfaces, web proxy solutions, and more, with more elegant solutions. The NISO FASTEN Working Group assessed the draft of the Queens Library API document with the aim of extending interoperability between various components: integrated library systems (ILS), vendor platforms and other library discovery software, and user devices. The intent is to modernize library-vendor interoperability to address current challenges, including creating consistent language and data objects using RESTful web service APIs while ensuring adherence to best practices, such as not passing personally-identifiable information between library and provider systems.

The NISO FASTEN Working Group was made up of product developers, librarians, and interested participants. Library vendors were an integral part, ensuring a view from all angles. We carefully considered the pain points of the library digital content experience and library and vendor business practices as we’ve described above. We have created a foundational API toolset that the library industry can build on to fulfill an array of user and library needs, leading to faster response times, improved discovery of resources, better integration, and an enhanced user experience. We have covered all steps of the experience, from log-in to return of digital materials. Our recommendations are aspirational: we wish to supplant the existing SIP standard with the more versatile Library Communications Framework API (LCF; see below for more details on LCF). We will, however, also provide some variations for those wishing to remain with SIP. Any extra work that vendors undertake in working towards the standards we recommend, however, will be more than rewarded as libraries—and their patrons—embrace digital content even more fully, pleased with a more secure, private, and above all easy and intuitive experience.

You will find the output of our work below, beginning with a definition of terms. A recommendation of best practices follows, with detailed specifications forming a conclusion that will help practitioners adopt the standards.
1.2 References

This Recommended Practice references the following documents. When cited in the text of the Recommended Practice, the document may be referred to by its number only or an abbreviated title. Where no date is supplied, the most current version of the document should be used.


1.3 Terms and Definitions

The following terms, as used in this recommended practice, have the meanings indicated.

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<th>Term</th>
<th>Definition</th>
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<td>API (Application Programming Interface)</td>
<td>Generic description of a method for exposing services and data through an advertised programming interface. Specification of the programming interface through either a proprietary or published standard is required.</td>
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| App (Application software)                | Software that runs on a patron’s device. In a FASTEN context, this usually refers to software provided by an e-Content Provider. An e-Content Provider’s app presents a starting point for patron interaction with e-Content. (Other starting points}
<table>
<thead>
<tr>
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<td>include the e-Content Provider’s Web site, and any interface provided by the ILS/Discovery layer.)</td>
<td></td>
</tr>
<tr>
<td>Discovery layer</td>
<td>A website or product through which users can discover content items. Discovery layers may be developed and maintained separately from the ILS/LMS.</td>
</tr>
<tr>
<td>e-Content</td>
<td>The products of the e-Content Provider. Potentially e-books, digital audio, film, television, music.</td>
</tr>
<tr>
<td>e-Content Provider</td>
<td>A vendor or supplier of e-content through an API</td>
</tr>
</tbody>
</table>
| ILS (Integrated Library System) / LMS (Library Management System) | Integrated library systems are multifunction software applications that allow libraries to manage, catalog and circulate their materials to patrons. In addition, this aggregate of technologies may also serve as a search, discovery and media delivery platform for the library. This software and its data is often managed directly by the library as its central software application.  
  
  In general, “ILS” is the acronym used in North America while “LMS” is the acronym used in UK/Europe.                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Library                                          | Libraries are the customers of Providers. Libraries may purchase e-Content on their own and/or as members of consortia.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Reservation / hold                                | A request made by a patron that a title be held/reserved.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| SSO (Single Sign-on)                             | A framework for authenticating users across a family of services. The user authenticates once, and all succeeding authentication requests are handled transparently by the service without requesting anything further from the user.                                                                                                                                                                                                                                                                                                                                 |
| User / Patron                                    | Patrons access e-Content through their Library, but are described as Users that access e-Content through provided system(s.)                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |

### 1.4 Guiding Principles

#### 1.4.1 Path to e-Content

FASTEN intends for patrons of a library to remain in the native library environment as much as possible, with as few steps as possible to access e-Content. The journey of the Patron to the Resource should be intuitive and, where possible, seamless: without the need for separate or repeated logins. The Patron should not be taken out of the native interface to the e-Content Provider’s, as this is disruptive to the Patron.

#### 1.4.2 Handling Personal Data

In FASTEN, as little personal data as possible about library Patrons is sent to e-Content providers. For situations where the Patron only interacts with the library’s ILS/Discovery layer, then no personal or identifying information at all needs to be sent to e-Content providers. In other situations, only an
anonymous or pseudonymous identifier needs to be sent. No other Patron information should ever be transmitted from the ILS/Discovery layer to an e-Content vendor.

1.4.3 Display of Content

The e-Content Provider should supply information in addition to general metadata (e.g., title, format, etc.) that supports appropriate use of the records or maintains existing links with grouped records. For instance, when supplying information which identifies titles in a curated list or collection, this collection information should be included alongside the title metadata. By doing so, these collections are preserved outside of e-Content Providers’ proprietary systems enabling the Patron to stay in the library domain.

In addition, where titles have specific constraints placed upon them, such as license rights, then e-Content Providers should return this information with the title metadata. For example, in consortial discovery, information about which libraries have access to the title is required in order to provide effective service.

As part of its support for implementation, the e-Content Provider should supply the ability for the Library to have control over which titles can be imported or found via a search; this allows the library’s ILS/Discovery layer to filter out titles based on a particular category or level.
Section 2: API Specification

2.1 Overview

FASTEN comprises three different tasks, which are to a large degree independent of each other:

- Authentication,
- Resource Synchronization, and
- the API which allows the ILS and the e-Content Provider to perform commands.

It is not necessary to implement all three. Authentication is perhaps the most important: it allows Patrons pseudonymous or anonymous access to resources via an established standard. It allows Patrons to start at either the e-Content Provider’s site or at the ILS. FASTEN authentication is the ideal way for all authentication of library Patrons to third party Providers to take place, even if they are not “e-Content Providers” per se.

Resource Synchronization is independent of Authentication. It enables libraries to make e-Content appear in the library catalog. Without implementing Authentication, Patron access to the discovered titles may be clunky or unfriendly, so it is recommended that Authentication be implemented.

The API “FASTEN Messages” allows Patrons to manage their accounts at e-Content Providers via the ILS. It may not be apparent or even relevant to a Patron that an account at a third party exists. This part of FASTEN certainly requires that Authentication be implemented, and also largely rests on Resource Synchronization.

2.2 Authentication

2.2.1 Vendor-to-Vendor Authentication

Clients should authenticate servers by trusting the TLS certificate servers present (most likely, this will be a typical CA certificate as commonly used on the public Web). Servers should authenticate clients by validating a username and password included in HTTP basic authentication or by verifying that the client possesses a client certificate which has been signed by the server. Either basic authentication or the client certificate must be included on each request.

2.2.2 Patron Authentication Introduction and Principles

FASTEN aims for:

- Anonymity: e-Content Providers are given as little information as possible about library patrons.
- Single sign-on (if signing on is necessary): the Library’s ILS (or other identity provider) is the sole repository of account information, and Patrons’ usernames and passwords are only ever sent to the identity provider, never to any other vendor.
- Confidentiality: Nothing in any way related to Patron data ever crosses the Internet unencrypted.

2.2.3 Single Sign-On

In FASTEN, Patrons have only one account: the account at their Library’s identity provider (most likely, the ILS). They do not have accounts with e-Content Providers.

If both sides fully implement FASTEN, then it’s possible for the Patron to interact with only the ILS and never the e-Content Provider directly. This situation is best for privacy: the ILS tells the e-
Content Provider what items should be checked in and out, but no information whatsoever about any Patron is needed to be sent at all.

The more common scenario (at least currently) is that the e-Content Provider has its own website or app (or both) which needs to authenticate Patrons. In this situation, OpenID Connect is the FASTEN mechanism for achieving single sign-on with the institution’s identity provider or with the Library’s ILS. Because logging out is an important consideration in this context, the optional OpenID Connect session management and logout specifications should also be implemented. (This prevents a Patron from logging into an e-Content Provider, then logging out, and not realizing that there’s still an active session with the ILS.)

2.2.4 Anonymity

The identity provider (ILS) should send no information about Patrons to the e-Content Provider, with the exception of an identifier (and even then, only when necessary). This identifier:

- Should not be based on a barcode, which could change.
- Should be pseudonymized: an identifier sent to a e-Content Provider should be meaningless in any other context, including other Providers which the ILS integrates with via FASTEN.
- May be fully anonymized: if the ILS/identity provider (or librarian using it) wishes Patrons to be fully anonymized, then a new pseudonymized identifier can be generated for a given Patron each time that Patron logs in. This prevents the e-Content Provider from knowing anything about any Patron across different login sessions. It may affect usability, in that the e-Content Provider’s website, app, etc. will not be able to list all the titles a Patron has checked out.
- May be completely unnecessary: if all interaction with the e-Content Provider takes place through the ILS, then the e-Content Provider never needs to see a Patron identifier at all.

Exception: There may be library business rules which grant or deny access based on the identity of the Patron, or on the Patron’s location (e.g., inside vs outside the library). If this is the case, then the identity provider (ILS) should include a list of title types which the Patron is not allowed to check out, if any. This list should appear in the identifier token, alongside “iss”, “exp”, “iat”; it should be called “disallowed_types”; and it should be a JSON array of type identifiers (supplied by the e-Content Provider) which any Patron from that IP address is not allowed to check out. If the array is absent or empty, then the Patron is eligible to check out titles of any type.

2.2.5 Confidentiality

All messages must be conducted via HTTPS. Some software libraries default to hostname verification being turned off; it (along with all the other verifications such as expiration date, etc.) must be enabled in production.

2.3 Resource Synchronization

There are two possible methods to include e-Content records in ILS/Discovery search results:

- Method A. The ILS/Discovery layer ingests MARC provided by the e-Content Provider.
- Method B. For each appropriate user search, the ILS/Discovery layer calls a search API provided by the e-Content Provider and includes e-Content results alongside its native results.
These are described in more detail below. In FASTEN, the approach to use is the one mutually agreed upon between the ILS and the e-Content Provider. It is recommended to use method A when practical. Method A becomes impractical when e-Content collections are prohibitively large.

Searching via the ILS/Discovery layer should not be a second-class experience compared with searching via an e-Content vendor’s website or app. “Pre-packaged” searches, collections, or lists that are available on an e-Content vendor’s platform should also be made available for ILS/Discovery layer use.

2.3.1 Method A - MARC ingestion

The protocol chosen for keeping the ILS MARC in sync with the e-Content Provider's MARC should meet the following requirements:

- Use an open, published, non-proprietary standard.
- Support baseline synchronization: the ILS must be able to perform an initial load or catch-up with a source at any time.
- Support Incremental synchronization - the ILS must be able to request and receive a list of changes since the last synchronization.
- Provide Audit information - the ILS must be able to verify that its current collection matches the e-Content Provider's collection.

The recommended mechanism for Method A at this time, particularly for new implementations, is ANSI/NISO ResourceSync. The Open Archives Initiative Protocol for Metadata Harvesting (OAI-PMH) specification also satisfies these requirements; it has been available for nearly twenty years and is described as a “low-barrier mechanism for repository interoperability.” The ResourceSync standard extends the OAI-PMH specification “using modern web technologies, and allows for the synchronization of the objects themselves, not just their metadata.”

2.3.2 Method B - Search API

The protocol chosen for real-time programmatic searching of the e-Content Provider's database should also be an open, published, non-proprietary standard. Current good options are:

- Z39.50
- SRU
- SRW

It’s recommended that new implementations utilize SRU: unlike Z39.50, it works on top of HTTP, so the lower-level protocol is better-supported by software libraries and firewalls; and it is simpler than the SOAP-based SRW.

It is beyond the scope of this document to specify exactly how to map a patron’s search query into a vendor’s Z39.50/SRU/SRW server, though future revisions may include more specific best practices.

2.3.3 Discovering file types

The ILS/Discovery Layer can determine the MIME type of a resource (most likely in order to determine whether it is an e-Book, audio, or video) by performing an HTTP HEAD request on the resource URL.

1 https://www.niso.org/standards-committees/resourcesync
2.3.4 FASTEN Messages

To support the required messages, the FASTEN Working Group searched for an existing message format rather than inventing a new one. A premium was placed on suitability for the functionality required, rather than current adoption of a particular format per-se by ILS and e-Content Providers. For that reason, the Book Industry Communication (BIC) Library Communications Framework (LCF) format was selected. LCF also allows for checkouts to take place without necessarily referencing an item-level datum such as a barcode.

Other protocols considered included:

- **SIP**: SIP is widely deployed but is now largely a legacy protocol. Many messages which FASTEN would require are not supported in SIP, and there is limited or no extensibility. SIP assumes that physical items are being checked out by barcode, which is not the case for e-Items.

- **NCIP**: NCIP is commonly deployed and is a much more modern, up-to-date, and extensible standard than SIP. However, most use of NCIP involves the ILS acting exclusively as a client. In FASTEN, ILSs are both clients and servers. Requiring a new "direction" limits the utility of the existing installed base. More critically, like SIP, NCIP assumes that items are physical items accessed by barcode, an assumption whose only workarounds are to largely bypass the standard’s defined elements and perform this task using the undefined <Ext/> element.

Note that the LCF standard refers to “items,” which in the context of FASTEN should be considered synonymous with “title.”

See [Section 1.2, References](#), for links to documents cited.

2.4 Supported Scenarios

2.4.1 Summary of Messages - Key

See the diagrams below for the messages in context of scenarios. As discussed above, FASTEN utilizes the LCF framework.

<table>
<thead>
<tr>
<th>Request #</th>
<th>LCF Message</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>Create Loan Request</td>
</tr>
<tr>
<td>2</td>
<td>Create Loan Response</td>
</tr>
<tr>
<td>3</td>
<td>Update Loan Request and Response</td>
</tr>
<tr>
<td>5</td>
<td>Update Loan Request and Response</td>
</tr>
<tr>
<td>6</td>
<td>Check In Loan Request and Response</td>
</tr>
<tr>
<td>7</td>
<td>Create message-alert</td>
</tr>
</tbody>
</table>
2.4.2 Overview

User Browser\Mobile Client -> LMS -> Content Provider

1. Request Access
2. Request Content
3. Return Content URL
4. Return Content URL

2.4.3 Failure Mode

User Browser\Mobile Client -> LMS -> Content Provider

1. Request Access
2. Request Content
3. Return Failure
4. Inform User

DRAFT FOR PUBLIC COMMENT
2.4.4 Success - Linked Content

2.4.5 Success - Embedded Content
2.4.6 Direct Vendor Access (Vendor to ILS communication)

Content servers MUST support the LCF loans API - i.e., respond to LCF messages to https://content.server/lcf/1.0/loans
Content servers MAY support LCF reservations/holds API - i.e., respond to LCF messages to https://content.server/lcf/1.0/reservations

An ILS can determine if a content server supports reservations/holds by making a GET request to https://content.server/lcf/1.0/reservations. A 404 or similar error would indicate that this is not supported.

An ILS may support notifications from a content server by providing (out of band) the content server with an LCF end point. An e-Content Provider can determine which notifications are supported by polling the following end points:
https://library.server.lcf.endpoint/lcf/1.0/loans
https://library.server.lcf.endpoint/lcf/1.0/reservations
https://library.server.lcf.endpoint/lcf/1.0/message-alerts
Receiving a 404 or similar error indicates that this is not supported.

2.5 Functionality

Content servers MUST support the LCF loans API - i.e., respond to LCF messages to https://content.server/lcf/1.0/loans
Content servers MAY support LCF reservations/holds API - i.e., respond to LCF messages to https://content.server/lcf/1.0/reservations

An ILS can determine if a content server supports reservations/holds by making a GET request to https://content.server/lcf/1.0/reservations. A 404 or similar error would indicate that this is not supported.

An ILS may support notifications from a content server by providing (out of band) the content server with an LCF end point. An e-Content Provider can determine which notifications are supported by polling the following end points:
https://library.server.lcf.endpoint/lcf/1.0/loans
https://library.server.lcf.endpoint/lcf/1.0/reservations
https://library.server.lcf.endpoint/lcf/1.0/message-alerts
Receiving a 404 or similar error indicates that this is not supported.
2.5.1 Create Loan

POST to https://content.server/lcf/1.0/loans

```xml
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<loan xmlns="http://ns.bic.org.uk/lcf/1.0" xmlns:ns2="http://a9.com/-/spec/opensearch/1.1/">
  <patron-ref>https://content.server/lcf/1.0/patrons/lms.server-id</patron-ref>
  <item-ref>https://content.server/lcf/1.0/items/item-id</item-ref>
  <start-date>checkout-date</start-date>
  <loan-status>01</loan-status>
</loan>
```

2.5.2 Create Loan Response

Location: https://content.server/lcf/1.0/loans/loan-id

```xml
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<loan xmlns="http://ns.bic.org.uk/lcf/1.0" xmlns:ns2="http://a9.com/-/spec/opensearch/1.1/">
  <identifier>loan-id</identifier>
  <patron-ref>https://content.server/lcf/1.0/patrons/lms.server-id</patron-ref>
  <item-ref>https://content.server/lcf/1.0/items/item-id</item-ref>
  <start-date>checkout-date</start-date>
  <end-due-date>due-date</end-due-date>
  <access-link>
    <link-type>01</link-type> <!-- Direct link to resource -->
    <link>https://content.server/content.pdf</link>
  </access-link>
  <access-link>
    <link-type>02</link-type> <!-- Indirect link to resource -->
    <link>https://content.server/viewer/content</link>
  </access-link>
  <loan-status>01</loan-status> <!-- checked-out -->
</loan>
```

2.5.3 Update Loan Request and Response

To update (or inform) ILS of loans made or changed at the e-Content Provider

POST to https://library.server/lcf/1.0/loans

```xml
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<loan xmlns="http://ns.bic.org.uk/lcf/1.0" xmlns:ns2="http://a9.com/-/spec/opensearch/1.1/">
  <loan-id>https://content.server/lcf/1.0/loans/loan-id</loan-id>
  <patron-ref>
    https://content.server/lcf/1.0/patrons/lms.server-id
    <!-- if original checkout originated from LMS - i.e. anonymous mode -->
    <!-- OR -->
    https://library.server/lcf/1.0/patrons/patron-id
    <!-- if original checkout originated from content provider - i.e. not anonymous mode -->
  </patron-ref>
  <item-ref>https://content.server/lcf/1.0/items/item-id</item-ref>
  <start-date>checkout-date</start-date>
  <end-due-date>due-date</end-due-date>
  <access-link>
    <link-type>01</link-type> <!-- Direct link to resource -->
    <link>http://content.server/content.pdf#PositionLocationID</link>
  </access-link>
  <access-link>
    <link-type>02</link-type> <!-- Indirect link to resource -->
    <link>http://content.server/viewer/content#PositionLocationId</link>
  </access-link>
</loan>
```
2.5.4 Check In Loan Request and Response

Request

PUT to https://content.server/lcf/1.0/loans/loan-id

<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<loan xmlns="http://ns.bic.org.uk/lcf/1.0" xmlns:ns2="http://a9.com/-
/spec/opensearch/1.1/"
  identifier=https://content.server/lcf/1.0/loans/loan-id</identifier>
  <patron-ref>
    https://content.server/lcf/1.0/patrons/lms.server-id
  </patron-ref>
  <item-ref>https://content.server/lcf/1.0/items/item-id</item-ref>
  <start-date>checkout-date</start-date>
  <end-due-date>due-date</end-due-date>
  <loan-status>08</loan-status>
</loan>

Response

<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<loan xmlns="http://ns.bic.org.uk/lcf/1.0" xmlns:ns2="http://a9.com/-
/spec/opensearch/1.1/"
  identifier=https://content.server/lcf/1.0/loans/loan-id</identifier>
  <patron-ref>https://content.server/lcf/1.0/patrons/lms.server-id</patron-ref>
  <item-ref>https://content.server/lcf/1.0/items/item-id</item-ref>
  <start-date>checkout-date</start-date>
  <end-due-date>due-date</end-due-date>
  <loan-status>08</loan-status>
</loan>
2.5.5 Reservation/Hold Request

Request

POST to https://content.server/lcf/1.0/reservations

```xml
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<reservation xmlns="http://ns.bic.org.uk/lcf/1.0" xmlns:ns2="http://a9.com/-
/spec/opensearch/1.1/">
  <reservation-type>02</reservation-type> <!-- any copy -->
  <patron-ref>https://content.server/lcf/1.0/patrons/lms.server-id</patron-ref>
  <item-ref>https://content.server/lcf/1.0/items/item-id</item-ref>
</reservation>
```

Response

```xml
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
/spec/opensearch/1.1/">
  <identifier>reservation-id</identifier>
  <reservation-type>02</reservation-type> <!-- any copy -->
  <patron-ref>https://content.server/lcf/1.0/patrons/lms.server-id</patron-ref>
  <item-ref>https://content.server/lcf/1.0/items/item-id</item-ref>
  <reservation-status>01</reservation-status> <!-- item available - in hold queue -->
</reservation>
```

2.5.6 Notify Reservation/Hold Status

To update (or inform) ILS of a reservation/hold made or changed at the e-Content Provider

POST to https://library.server/lcf/1.0/reservations

```xml
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<reservation xmlns="http://ns.bic.org.uk/lcf/1.0" xmlns:ns2="http://a9.com/-
/spec/opensearch/1.1/">
  <identifier>https://content.server/lcf/1.0/reservations/reservation-id</identifier>
  <reservation-type>02</reservation-type> <!-- any copy -->
  <patron-ref>
    https://content.server/lcf/1.0/patrons/lms.server-id
    <!-- if original checkout originated from IMS - i.e. anonymous mode -->
  </patron-ref>
  <item-ref>https://content.server/lcf/1.0/items/item-id</item-ref>
  <reservation-status>01</reservation-status> <!-- item available - in hold queue -->
</reservation>
```

Response

```xml
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<reservation xmlns="http://ns.bic.org.uk/lcf/1.0" xmlns:ns2="http://a9.com/-
/spec/opensearch/1.1/">
  <identifier>https://content.server/lcf/1.0/reservations/reservation-id</identifier>
  <reservation-type>02</reservation-type> <!-- any copy -->
  <patron-ref>
    https://content.server/lcf/1.0/patrons/lms.server-id
    <!-- if original checkout originated from IMS - i.e. anonymous mode -->
  </patron-ref>
  <item-ref>https://content.server/lcf/1.0/items/item-id</item-ref>
</reservation>
```
2.5.7 Create Message Alerts

POST to https://library.server/lcf/1.0/message-alerts

```xml
<message-alert xmlns="http://ns.bic.org/lcf/1.0">
  <!-- optional fields: priority display-type display-constraint start-date end-date -->
  <message-type>01</message-type> <!-- Action required -->
  <message-text>
    <message-format>03</message-format> <!-- Unicode -->
    <text>Message</text>
  </message-text>
  <audience>03</audience>
  <!-- Patrons related to specified loans
       or 04 for reservations -->
  <loan-ref>https://content.server/lcf/1.0/loans/loan1-id</loan-ref>
  <loan-ref>https://content.server/lcf/1.0/loans/loan2-id</loan-ref>
  <loan-ref>https://content.server/lcf/1.0/loans/loan3-id</loan-ref>
</message-alert>
```

Response

```xml
<message-alert xmlns="http://ns.bic.org/lcf/1.0">
  <identifier>message-id</identifier>
  <message-type>01</message-type> <!-- Action required -->
  <message-text>
    <message-format>03</message-format> <!-- Unicode -->
    <text>Message</text>
  </message-text>
  <audience>03</audience>
  <!-- Patrons related to specified loans
       or 04 for reservations -->
  <loan-ref>https://content.server/lcf/1.0/loans/loan1-id</loan-ref>
  <loan-ref>https://content.server/lcf/1.0/loans/loan2-id</loan-ref>
  <loan-ref>https://content.server/lcf/1.0/loans/loan3-id</loan-ref>
</message-alert>
```
Section 3: General Recommendations

3.1 Appropriate design and interface design

The Library should display data from or integrate the API in a way which is consistent with the Resource. For example, it would be inappropriate to have media buttons (such as play, stop, etc.) to control an e-book or to require “hover” functionality for mobile devices.

3.2 Handling multiple sources

Libraries should aim to incorporate all matching search results into a single-result interface in order to present the Patron with a comprehensive list of matching resources.

Handling multiple sources will mean that e-Content Providers should enable mechanisms to provide “graceful failure” in order to support the continuation of Library systems and programs, even if resources from a particular API are unavailable.

3.3 Resource information

Where information or content regarding a resource is available on an e-Content Provider’s platform, this data should be available to the Library via an API. For example, where resources—including the formation of categories, collections or lists—are licensed by the Library, then these elements, as well as the Resource itself, should be available for integration into the Library’s platform.

3.4 Finding and Using Content

3.4.1 Title-Level Checkouts

Checkouts should be performed at the title level, not at the file format level: checking out a title should provide access to all file formats in which that title is available. For example, if a given e-Book is available in Kindle and EPUB formats, a single checkout should grant access to both. This does not necessarily apply across media; for example, checking out an e-Book does not necessarily grant access to an e-Audiobook version of that title.

In academic environments, a Library can access the same title of an e-book via multiple access rights from different e-Content Providers.

3.4.2 Streaming Content

When streaming content that does not require digital rights management (DRM) or check-out, the Patron experience should be seamless: Patrons should immediately access the streamed content and should not be required to register for accounts or install additional software or streaming applications. Ideally the entire experience for such content should occur within the context of the library’s ILS/Discovery layer.

3.4.3 Display of Content

The e-Content Provider should supply information in addition to general metadata (e.g., title, format, etc.) that supports appropriate use of the records or maintains existing links with grouped records. For instance, when supplying information which identifies titles in a curated list or collection, this collection information should be included alongside the title metadata. By doing so these collections are preserved outside of e-Content Providers’ proprietary systems and enables the Patron to stay in the library domain.
In addition, where titles have specific constraints placed upon them, such as license rights, then e-Content Providers should return this information with the title metadata. For example, in consortial discovery, information about which libraries have access to the title is required in order to provide effective service.

As part of its support for implementation, the e-Content Provider should supply the ability for the Library to have control over which titles can be imported or found via a search; this allows the library’s ILS/Discovery layer to filter out titles based on a particular category or level.

### 3.5 Functional Considerations

Supply of APIs to Libraries requires certain technical or functional considerations by the e-Content Provider. The purpose of these considerations is to help the Library implement the APIs while striving to reduce elements of doubt about their technical capability. For instance, e-Content Providers’ attention to these details will provide clarity over whether the endpoint is suitable for Libraries’ needs, provision of testing APIs, or dealing with changes/new releases.

#### 3.5.1 Provision of a testing/sandbox API

With each production API provided, the e-Content Provider should support a testing or ‘sandbox’ API that exactly replicates the production API in terms of content and functionality. This test access enables the Library to perform complete and accurate testing in terms of content and functionality before full public implementation, and establishes confidence in e-Content Provider-Library services.

#### 3.5.2 Changes to an endpoint

Before an e-Content Provider makes any changes to the endpoint of its API, it should communicate to Libraries, well in advance, the nature of the changes and, for a reasonable time, allow both old and new endpoints to run simultaneously before removing the old one(s).

### 3.6 Help Pages and Error Handling

#### 3.6.1 Graceful in failure

When building help around APIs or around services that make use of delivered APIs, the user experience should be graceful in failure providing descriptive help, outlining where an error occurred and possible reasons why it did. Help should be descriptive for Library developers but also offer a meaningful message to the Patron, building upon the wide range of descriptive error messages that are generally available. Messages designed for Patrons should provide information on how to recover from the problem (if possible), or provide contact information for assistance.

#### 3.6.2 Avoid enormous “select your library” pulldowns

Traditionally, e-Content Provider applications must, at least one time, make the Patron select their library in order to log in. Often this involves a large list of all libraries with which the e-Content Provider has a relationship. GPS location or prompts for ZIP codes can help shorten the list, although that requires yet another prompt.

If the Patron starts with the e-Content app, this selection is probably unavoidable. However, if the Patron starts with the ILS, then there are ways to reduce the inconvenience: If the app resides on the same device that is used for ILS login, none of this may be necessary as ILS login data may be utilized.
The e-Content Provider should generate a code of approximately six characters, either when a Patron logs in or when information about connecting an app is requested. The code should only be valid for a relatively brief length of time (probably no more than an hour).

This code can be entered into the app and will associate the app with the correct library. It may also log the Patron in. This might not be the only way the Patron can log in to the app: if the Patron starts at the app rather than the ILS next time, the app can handle the login, but will be able to skip the "select your library" step.
Section 4: Future Considerations

The following item is not fully addressed in this Recommended Practice and should be considered for a future revision, once feedback is received from implementers.

ILS requesting current information from e-Content Provider:

The ILS should be able to request the following information from the e-Content Provider about any Patron. This data is important for enforcing library checkout rules that apply across physical items and one or more e-Content Providers.

- Current checkouts
- Current holds
- Current fines (This may be something that only applies to the potential use of FASTEN between an ILS and a discovery layer.)