

Merge Operation

WORK IN PROGRESS

Operation POST `[base]/Patient/$merge`

(this does **not** perform on the actual resource instance e.g. `[base]/Patient/01/$merge`)

The target is the remaining patient resource (survivor), the source will be marked as inactive

The source-patient resource will be updated to add a new link reference to the target-patient resource (link-type=replaced-by), and also update the status to inactive

The target-patient resource will be updated to add a new link reference to the source-patient resource (link-type=replaces) - *and must be included in the result-patient parameter if used (if the source patient is deleted, then this link is not required)*

Parameters

Parameter Name	Card	Type	Description
source-patient	0..1	ResourceReference	A direct resource reference to the source patient resource (this may include an identifier)
source-patient-identifier	0..*	Identifier	The Identifier(s) of the source patient resource, all of these identifiers MUST be present in the located resource (in addition to the one included in the resource reference above - if included) (The purpose of this property is to ensure that the correct source patient resource is selected)
patient	0..1	ResourceReference	A direct resource reference to the target patient resource This is the surviving patient resource, the target for the merge
patient-identifier	0..*	Identifier	The Identifier(s) of the target patient resource, all of these identifiers MUST be present in the located resource (The purpose of this property is to ensure that the correct source patient resource is selected)
result-patient	0..1	Resource (Patient)	The details of the Patient resource that is expected to be updated to complete with. This resource MUST have the link property included referencing the source patient resource It will be used to perform an update on the target patient resource The absence of this parameter the servers should copy all identifiers from the source patient into the target patient, and include the link property (as shown in the example below) This is often used when properties from the source patient are desired to be included in the target resource The receiving system may also apply other internal business rules onto the merge which may make the resource different to what is provided here. If this to be a new Patient resource, the patient.Id will be blank, and the server will be required to create that resource (feedback required - should we permit this?) - resulting in a completely new Patient record, and all resources linked to either of the patient resources merged will be updated to refer to it
preview	0..1	boolean	If this is set to true, then the merge would not be actually performed, however an OperationOutcome would be returned indicating how many resources of what types would be impacted by the change. e.g. Issue.diagnostics "Require updates: 23 Observations, 3 CarePlans" <i>(draft concept only)</i>
RETURN	1..1	Patient or OperationOutcome or Task (async result)	If the operation was requested as a preview, an OperationOutcome will be returned with either <ul style="list-style-type: none">• 200 OK - If the merge request doesn't expect any issues• 400 Bad Request - if there are errors expected, and a list of issues in the outcome If the operation encounters an error in processing, then an OperationOutcome will be returned as above <ul style="list-style-type: none">• 400 Bad Request - if there are errors expected, and a list of issues in the outcome If the operation accepted for processing, and is to continue asynchronously to update all reference data, then: <ul style="list-style-type: none">• 202 Accepted - and a Task Resource or OperationOutcome will be returned If the operation completed all processing and did not require to continue processing: <ul style="list-style-type: none">• 200 OK - if the Merge is complete, all data is updated, and return the target Patient as was completed, or an OperationOutcome• 201 Created - if the result patient was to create a new patient (need feedback if this is permitted)

There must be at least 1 source patient/patient-identifier parameter, and at least 1 target patient/patient-identifier parameter

The result-patient.id must be the same as the target patient reference

A server May decide to delete the source record, but is not defined by the standard merge operation.

Merging Identifiers

If the result patient is provided in the parameters to the operation, then it is assumed that the caller has correctly included all the required identifiers desired to be in the target patient.

If the result patient is not provided, then the values provided in the request parameters (source-patient.identifier and all source-patient-identifiers) will be copied into the target resource and marked as old.

The server may also migrate other identifiers (and properties) at its discretion, and chose to mark these as old or not.

Note: If an identifier value is masked, then the server will migrate the identifier value correctly, regardless of the masking.

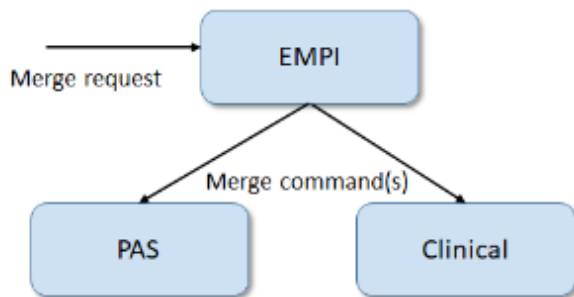
Updating Data that References the source Patient

While updating resources that reference the source patient, ensure that the target patient link value isn't also accidentally updated.

(This may update any other patient resources that were previously merged into the source patient record)

Other Notes

The context of the merge operation could be either within an EHR (or similar system), or within an EMPI service.



The system that receives the initial \$merge operation and processes this and returns the result.

Other downstream systems may be updated at a later time. This update request could also use the same \$merge operation on the downstream system, or could use other integration engine approaches, such as sending v2 messages. The downstream merge would know which 2 records were in the downstream system, and thus what data should be updated.

Consideration should be taken to ensure that the correct data is acted on.

The downstream systems may not have all identifiers that the EMPI has, the EMPI may be configured to know what "types" of identifiers should be propagated to which systems.

When using the identifier parameters (rather than id) you should be using the same assigner (which in the example above would be the PAS or clinical system)

Merging different records in downstream systems, joining records in the EMPI

In the case where there aren't 2 records in the clinical system, then a simple update could be used.

Further consideration on the identifier assigning authority needs to be done.

In HL7 v2, the trigger message only reports the results of the operation, and has PID and merged from PID

Question: Should support for a simple query parameter form of the operation be permitted? (using the form used in search url|value for identifiers, and the resource references will just include the reference value (no identifiers)

Cooper Thompson 9/15/2019 3:51 PM - this wouldn't be idempotent, so I would think this really should be a POST, even if it *could* be a GET.

Question: How should privacy related meta tags be handled? When reconciling 2 patient resources to be merged, any security or privacy related tags should be included in the resulting target resource with the most sensitive values surviving.

Question: Should a **Task** resource be included to track things that might take longer to process? Yes.

Question: Should we be explicit about how the identifiers from the source resource should be copied into the target resource (and if they should be marked with use=old), the system will not be expected to make these decisions in the operation, the caller of the operation will make those decisions, which are defined in the result-patient resource. For a case where this was an old MRN, we recommend that these also remain in the target resource so that if content comes in (such as a lab result) with the old MRN on it, then it can be attached to the appropriate.

Question: What should happen if the 2 patient resources are already merged, an error code?

Question: Should the merge operation update/correct/change all the resources that reference the patient to link to the resulting patient resource. E.g. Any Observations referencing Patient/01 will be changed to Patient/02

Question: Provenance/AuditEvent actions - any security issues here?

After some discussion, the Provenance is the preferred resource to track this content, as will likely remain with the clinical data retention, however the AuditEvents may be cleansed periodically.

Question: Will the spec also describe an \$unmerge style operation, or will that be essentially a manual activity on the API using the Provenance /AuditEvents to determine context.

Question: Should the updating process be able to be performed synchronously, or async? - Prefer to support Async given the potential duration the processing could take for some long term records

Note: The preferAsync header is intended for large data results, not long data processing results.

Question: Should there be a mode parameter to get an estimate on what would be impacted by the merge - an aggregate on how many resources on each side etc.

Question: Should we be able to merge 3 patients into 1? Suggest keep it simple at 1 into 1 for now.

Question: During the processing of data for a merge operation (which can take some time), any query for a resource that references either source or target patient could be returning partial content, and operation outcome could be returned in the search bundle indicating this - it's really a warning or information case. Resources like medications or allergies could be significant in this situation.

Question: What should happen to the source patient post merge? Should it be deleted, marked as inactive, hidden from searches? What impact on subscriptions and lists?

Question: Should there be a pre-merge or dry run merge operation to check the scale of the operation, this could be useful to check the scale. If the results were to be reported, it can be an estimate, and doesn't really need to be broken down into resource types, its just to help advise age of the record. This **preview** parameter satisfies this need.

Question: Should a search on the old MRN identifier return both the old patient and target patient resources, or just the target patient resource? How do we filter out the old resource? Rely on the inactive flag?

Question: Should the merge itself mark the source as inactive? Suggest that this is a good idea.

Question: Should other resources, such as Patient Accounts, be merged too? Or is that a supplementary exercise? Could they be tagged with Task resources for review?

Other considerations could be claims to be withdrawn, communications in process to be cancelled.

Question: Should anything happen with SMART App Launch tokens that have the Patient ID in them? If they were revoked, that would be the cleanest, as apps need to handle this and would just challenge for a new token, which would get the new value

Question: If the 2 patient resources had links to each other, should those be removed?

Question: How would a merge be reflected in subscriptions?

Question: Should the merge operation also be reflected in the Person Resource - expect that would just update as per any other resource type with a reference to the patient resource.

Question: How can we merge multiple patients into 1 record? This is typically done using multiple calls to the operation. e.g. merge: AC, merge: BC

Question: How do Patient (or other users) accounts with access be changed (these aren't fhir resources)

Post Merge Expectations

Once the patient resources have been merged:

Should a GET on the old Patient resource ID return: e.g. GET [base]/Patient/pat01

- 404 not found (when the merge system deleted the resource)
- 301 Redirect to the new Patient ID
- 200 Ok and returns the old Patient which is now marked as inactive, and has the link (replaced-by) populated with the new Patient ID

Should a SEARCH by the old Patient Resource ID return: e.g. GET [base]/Patient?_id=pat01 (often used as a substitute for direct GET when doing _include for the managing org/general practitioner)

- 200 Ok Bundle with no patient resource (case where the old patient was deleted)
- 200 Ok Bundle with the inactive patient which is marked as inactive and has the link (replaced-by) populated in it (that you'll need to follow to get any further data)
- 200 Ok Bundle with the target patient resource (with the link to the one from the search) and not include the old patient resource
- 200 Ok Bundle with both the target and old patient resources

How would interactions on \$everything or the patient compartment on the old patient resource be effected by the merge? It could redirect itself?

How will this effect the \$match operation? should it also return the inactive resources? If that operation definition does not return inactive resources, then no problem here.

Impact on Subscriptions

There is a whole discussion on the impact on subscriptions, so won't try and replicate all of that, but instead summarize the issues

- What can be used as triggers for the subscription
 - Patient update with new link values
 - operation itself as an event
 - Provenance(s) as an event
 - The Task doing the Merge operation
- Will all the data that is patched over to the target patient ID be notified

Example \$merge operation parameters resource

```
POST: [base]/Patient/$merge
<Parameters xmlns="http://hl7.org/fhir">
  <parameter>
    <name value="source-patient" />
    <valueReference>
      <reference value="Patient/01" />
      <identifier>
        <use value="official" />
        <type>
          <coding>
            <system value="http://www.hospital-a/localid" />
            <code value="HospitalA" />
            <display value="Hospital A" />
          </coding>
          <text value="Hospital A" />
        </type>
        <system value="urn:oid:2.16.840.1.113883.3.72.5.9.1" />
        <value value="1000000001" />
        <assigner>
          <display value="Hospital A" />
        </assigner>
      </identifier>
    </valueReference>
  </parameter>
  <parameter>
    <name value="patient" />
    <valueReference>
      <reference value="Patient/02" />
      <identifier>
        <use value="official" />
        <type>
          <coding>
            <system value="http://www.hospital-a/localid" />
            <code value="HospitalA" />
            <display value="Hospital A" />
          </coding>
          <text value="Hospital A" />
        </type>
        <system value="urn:oid:2.16.840.1.113883.3.72.5.9.1" />
        <value value="1000000002" />
        <assigner>
          <display value="Hospital A" />
        </assigner>
      </identifier>
    </valueReference>
  </parameter>
  <parameter>
    <name value="patient-identifier" />
    <valueIdentifier>
      <system value="http://example.org/SSN" />
      <value value="804234513" />
    </valueIdentifier>
  </parameter>
</Parameters>
```

```

</parameter>
<parameter>
  <name value="result-patient" />
  <resource>
    <Patient xmlns="http://hl7.org/fhir">
      <id value="02" />
      <identifier>
        <use value="official" />
        <type>
          <coding>
            <system value="http://www.hospital-a/localid" />
            <code value="MRN" />
          </coding>
          <text value="Hospital A MRN" />
        </type>
        <system value="http://www.hospital-a/localid" />
        <value value="1000000002" />
        <assigner>
          <display value="Hospital A" />
        </assigner>
      </identifier>
      <identifier>
        <use value="old" />
        <type>
          <coding>
            <system value="http://www.hospital-a/localid" />
            <code value="MRN" />
          </coding>
          <text value="Hospital A MRN" />
        </type>
        <system value="http://www.hospital-a/localid" />
        <value value="1000000001" />
        <assigner>
          <display value="Hospital A" />
        </assigner>
      </identifier>
      <identifier>
        <system value="http://example.org/SSN" />
        <value value="804234513" />
      </identifier>
      <name>
        <family value="LINCOLN" />
        <given value="MARY" />
      </name>
      <name>
        <use value="old" />
        <family value="WASHINGTON" />
        <given value="MARY" />
      </name>
      <gender value="female" />
      <birthDate value="1954-07-04" />
      <link>
        <other>
          <reference value="Patient/01" />
          <display value="Mary Lincoln" />
        </other>
        <type value="replaces" />
      </link>
    </Patient>
  </resource>
</parameter>
</Parameters>

```

Further Event Processing

While updating the system, any records that were referencing the source resource will be updated to reference the target resource.

A Provenance resource and an AuditEvent resource will be created that references all resources that are modified during the processing, this may be referenced to perform an un-merge, which will detect if any additional resources have been created that weren't processed during this time, and will require manual checking.

Notification Mechanisms

How does the EMPI (or other receiving system) notify other dependent systems that the merge has occurred/completed?

This could be through several ways. It could be through:

- An integration engine sending HL7v2 A40 merge message (*A18 may also be applicable in backward compatibility modes*)
- Directly calling the \$merge operation on the dependent systems
- Using FHIR Messaging to invoke the same operation
- Using Subscriptions to detect the merge operation has occurred (active discussions in subscriptions on this)

Reporting Errors/Outcomes

Any errors will be reported with an OperationOutcome resource and could include

Issue	Description	Http Status
err: Same resource	The Source and Target matching resulted in the same FHIR Patient resource, likely already merged.	Bad Request
err: Missing Source Parameters	There are no source patient parameters, please include either a source-patient, source-patient-identifier parameter (or both)	Bad Request
err: Missing Target Parameters	There are no target patient parameters, please include either a target-patient, target-patient-identifier parameter (or both)	Bad Request
err: Target Patient Id mismatch	The target patient id does not match the patient id in the result-patient resource (should we permit this to create a new resource?)	Bad Request
err: Source Patient not found	The source patient was not found based on the provided parameters	Bad Request
err: Target Patient not found	The target patient was not found based on the provided parameters	Bad Request
err: Target/Source not duplicates	Attempt to merge 2 records that are known to not be duplicates of each other. <i>(Previous manual marking of the resources was done, and will need to be removed before retrying)</i>	Bad Request
err: Target patient already merged	The Target patient resource was previously merged into another patient record	Bad Request
err: Target patient inactive	The Target patient resource is marked as inactive	Bad Request
info: Target Patient updated	Additional notes on what happened to the target patient resource on update, such as if fields weren't updated as requested due to internal business rules etc	
info: Update summary	Other notes that are included reporting on what changed, such as how many resources were/may be effected	
warn: Recomend reverse merge	The source resource is much larger than the target resource (in terms of resources that reference it) and recommend that the merge occur in the other direction	

FHIR Messaging

The FHIR Request Message should be a Bundle with:

Resource		Description
MessageHeader	1..1	The Messaging header The focus of the message will be the Parameters resource
Parameters	1..1	The same Parameters object that would be passed to the \$merge operation

Patient (result)	1..1	The resulting Patient resource that we would be expecting to be completed The Patient.id of this resource may be absent, as with the messaging, it may not be known a message generation Brian: This is not required, as it is already in the parameters resource, however should note that this is required in the parameters object when used in messaging
Patient (source)	0..1	Source Patient resource (may not be complete, but should have enough to be able to identify the source record) This is the details of the patient resource that will be marked as inactive after the merge
Patient (target)	0..1	Target Patient resource (may not be complete, but should have enough to be able to identify the target record) This is the details patient resource that will remain active after the merge operation is complete

Note: If the target patient resource has an id, then the resulting patient.id value must be either blank, or the same resource Id.

Operationally, on the receiving system, the end result will be that the id on the patient result and target patient are the same.

The FHIR Response Message should be a bundle with:

Resource		Description
MessageHeader	1..1	The Messaging header The focus of the message will be the Parameters resource
Parameters	1..1	The parameters resource that was included in the request
OperationOutcome	1..1	The results of the merge operation
Patient	0..1	The resulting patient resource from the merge operation (required when the result was a successful operation)
AuditEvent	0..1	An operation event that includes the full details of the operation, including references to all the resources that were updated as a result of the merge

Example Provenance

```

<Provenance xmlns="http://hl7.org/fhir">
  <id value="add4712f870b484dada83e80a249d7fb" />
  <meta>
    <versionId value="2" />
    <lastUpdated value="2019-09-15T17:39:26.3561523-04:00" />
  </meta>
  <text>
    <status value="generated" />
    <div xmlns="http://www.w3.org/1999/xhtml">
      <span style="color: gray;">target:</span> Patient/pat2/_history/41<br /><span style="color: gray;"
>target:</span> Patient/pat1/_history/63<br /><span style="color: gray;">activity:</span> Merge Record
Lifecycle Event<br /><hr /><span style="color: gray;">who:</span> Fixmeup, Steve Dr
    </div>
  </text>
  <target>
    <reference value="Patient/pat2/_history/41" />
  </target>
  <target>
    <reference value="Patient/pat1/_history/63" />
  </target>
  <occurredPeriod>
    <start value="2019-09-15T17:38:56.3087526-04:00" />
    <end value="2019-09-15T17:39:26.3544498-04:00" />
  </occurredPeriod>
  <recorded value="2019-09-15T17:38:56.3087526-04:00" />
  <reason>
    <coding>
      <system value="http://terminology.hl7.org/CodeSystem/v3-ActReason" />
      <code value="PATADMIN" />
    </coding>
    <text value="patient administration" />
  </reason>
  <activity>
    <coding>
      <system value="http://terminology.hl7.org/CodeSystem/iso-21089-lifecycle" />
      <code value="merge" />
    </coding>
    <text value="Merge Record Lifecycle Event" />
  </activity>
  <agent>
    <type>
      <coding>
        <system value="http://terminology.hl7.org/CodeSystem/provenance-participant-type" />
        <code value="performer" />
      </coding>
      <text value="Performer" />
    </type>
    <who>
      <identifier>
        <value value="UID123234" />
      </identifier>
      <display value="Fixmeup, Steve Dr" />
    </who>
  </agent>
</Provenance>

```