

Presentation on Example Federation APIs Case in the ongoing work in Joint Work of ETSI TC INT and ITU-T SG11 Q.API4TB on Open APIs for interoperable testbed federations

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Work in progress



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CONTRIBUTION

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Title: ITU-T Q.API4TB "Open APIs for interoperable testbed federations" – Proposal to advance the baseline text during the next meeting

Purpose: Information

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Abstract: This contribution proposes updates to the output baseline text of the draft Recommendation ITU-T Q.API4TB "Open APIs for interoperable testbed federations" which was prepared based on the outcomes of discussion during the joint Q16/11 – ETSI TC INT e-meeting on 25 February 2021.

Context

- Recent technological developments require more realistic tests.
- New use cases to be validated in real conditions.
- Assessment of the scalability.

- Consequences:
 - The role of testbeds is more important.
 - Needs of testbed federations and interconnections between testbeds.
 - Requires a set of clearly standardized APIs to exploit testbeds and their resources in interoperable testbed federations.

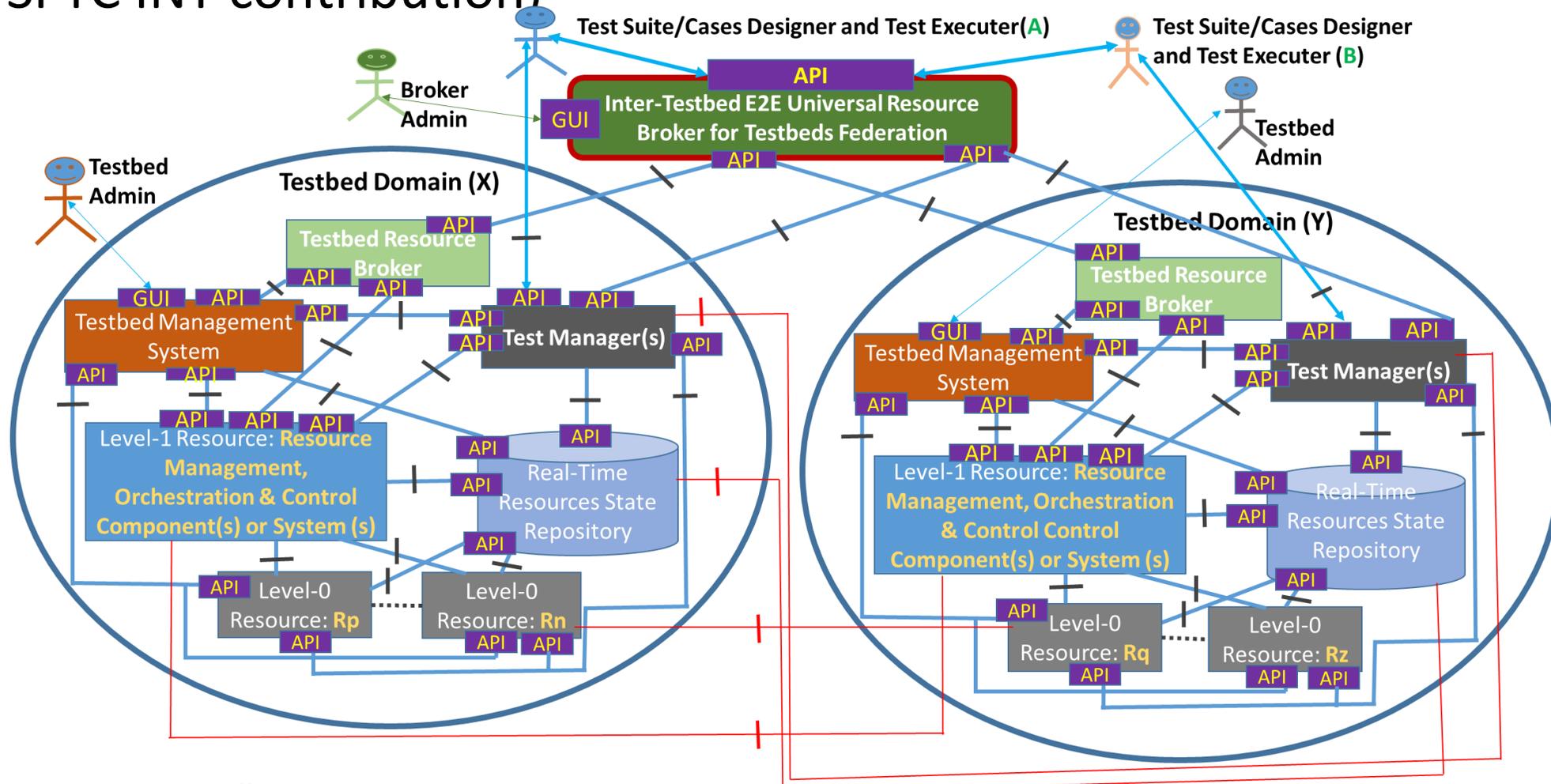
Objectives of the Recommendation

- Definition of potential improvements for the testbed interoperability and federation.
- Description of a reference model for interoperable testbed federations.
- Specification of open APIs for the interconnection and interoperability among testbeds.
- Definition of reference metrics easing the integration and the interoperability of testbeds.

Terms defined in this Recommendation

- **Project:** A project is a group of resources used for a defined purpose.
- **Sliver:** A sliver is a physical or virtual resource or several resources provided by only one testbed.
- **Testbed:** A testbed is a platform to realise scientific tests with new technologies.
- **(Testbed) slice:** A (testbed) slice is a collection of slivers available in different testbeds.

Proposed Generic Reference Model for Testbeds Federation and key Players (ETSI TC INT contribution)

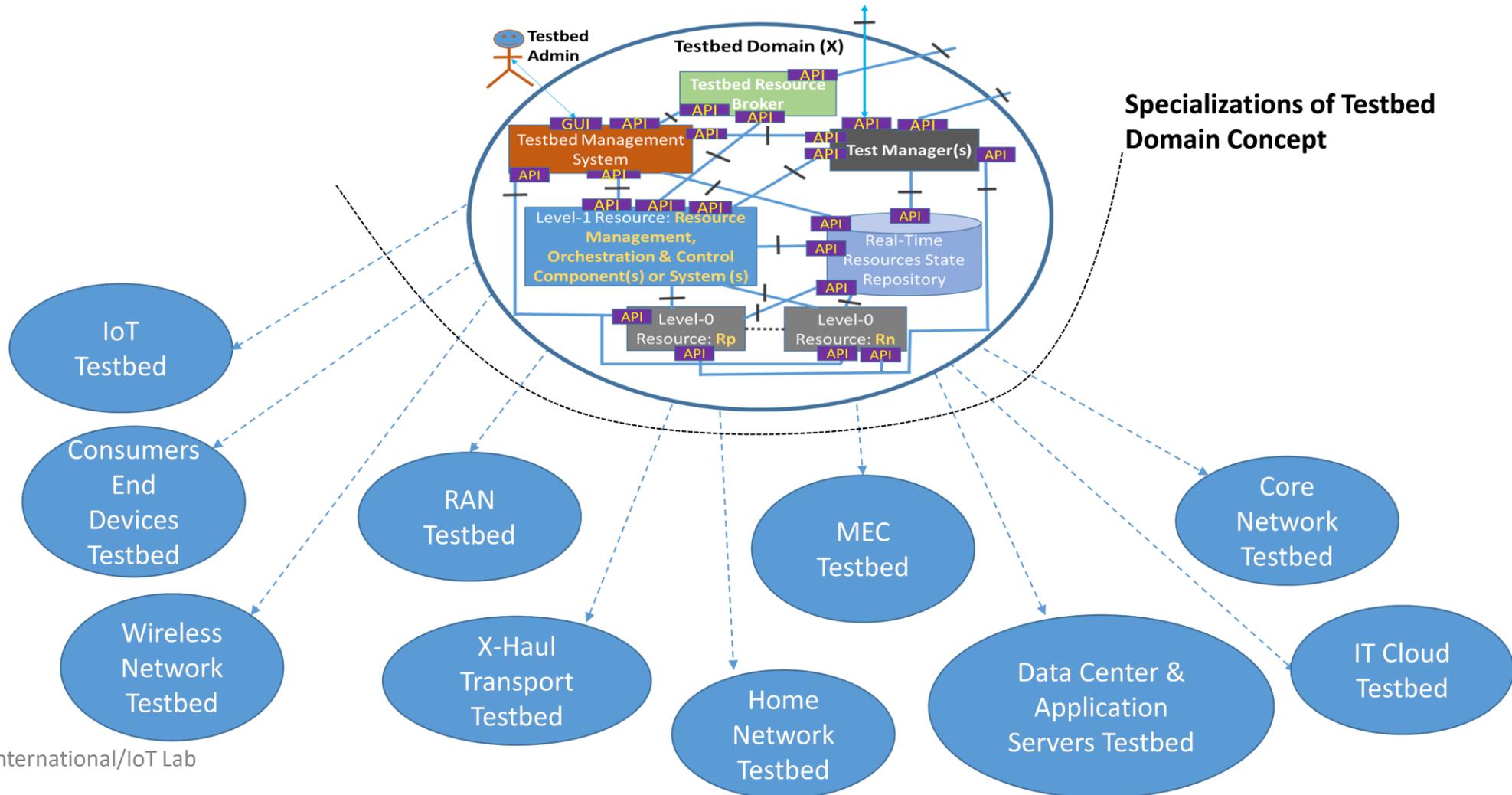


Key:

There may be established Horizontal and/or Hierarchical/Vertical Federations of Assets/Components or Resources at specific Levels across Federated Testbeds

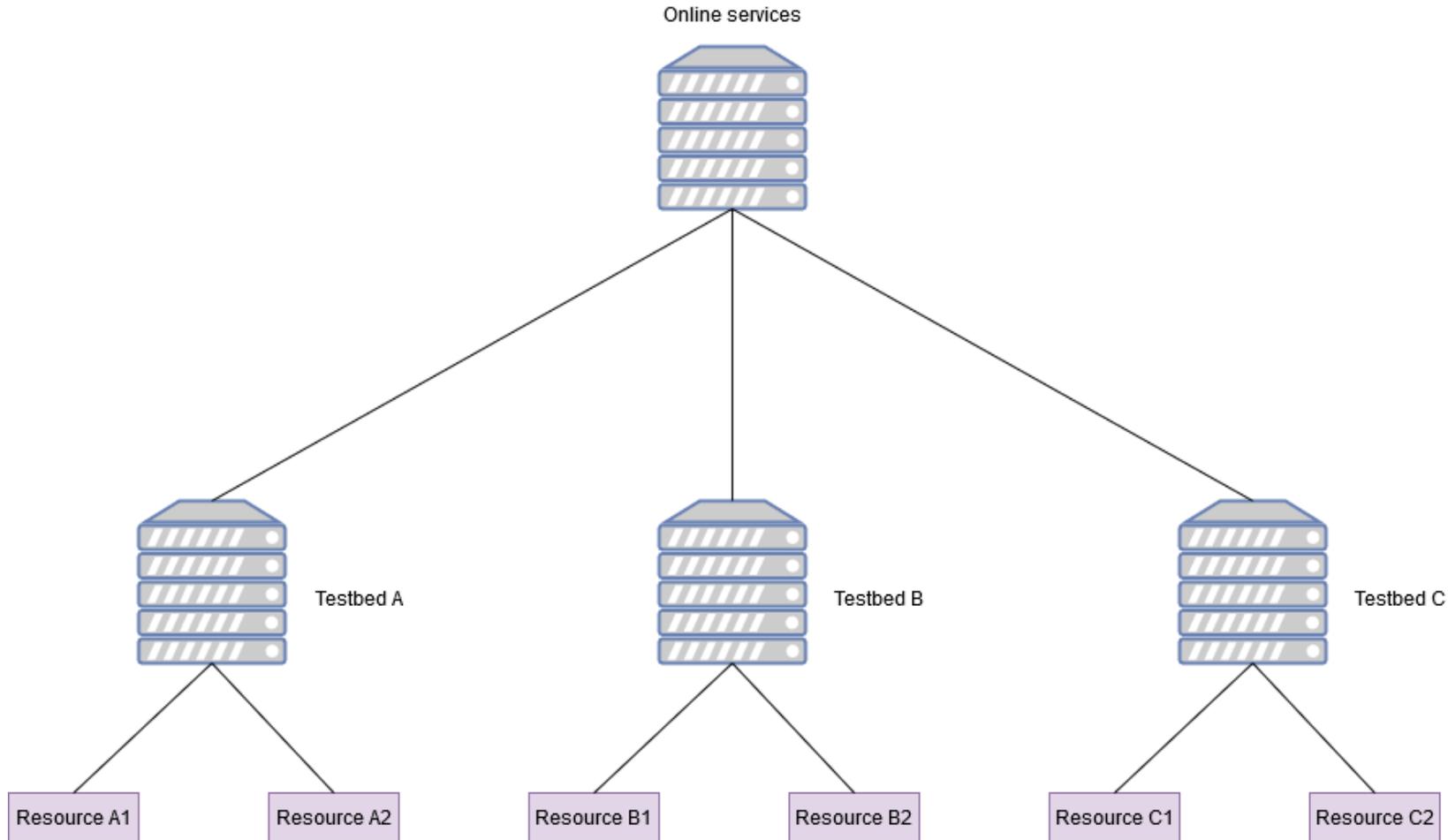
Proposed Generic Reference Model for Testbeds Federation and key Players

(ETSI TC INT contribution) **Specializations of the Testbed Domain Concept**

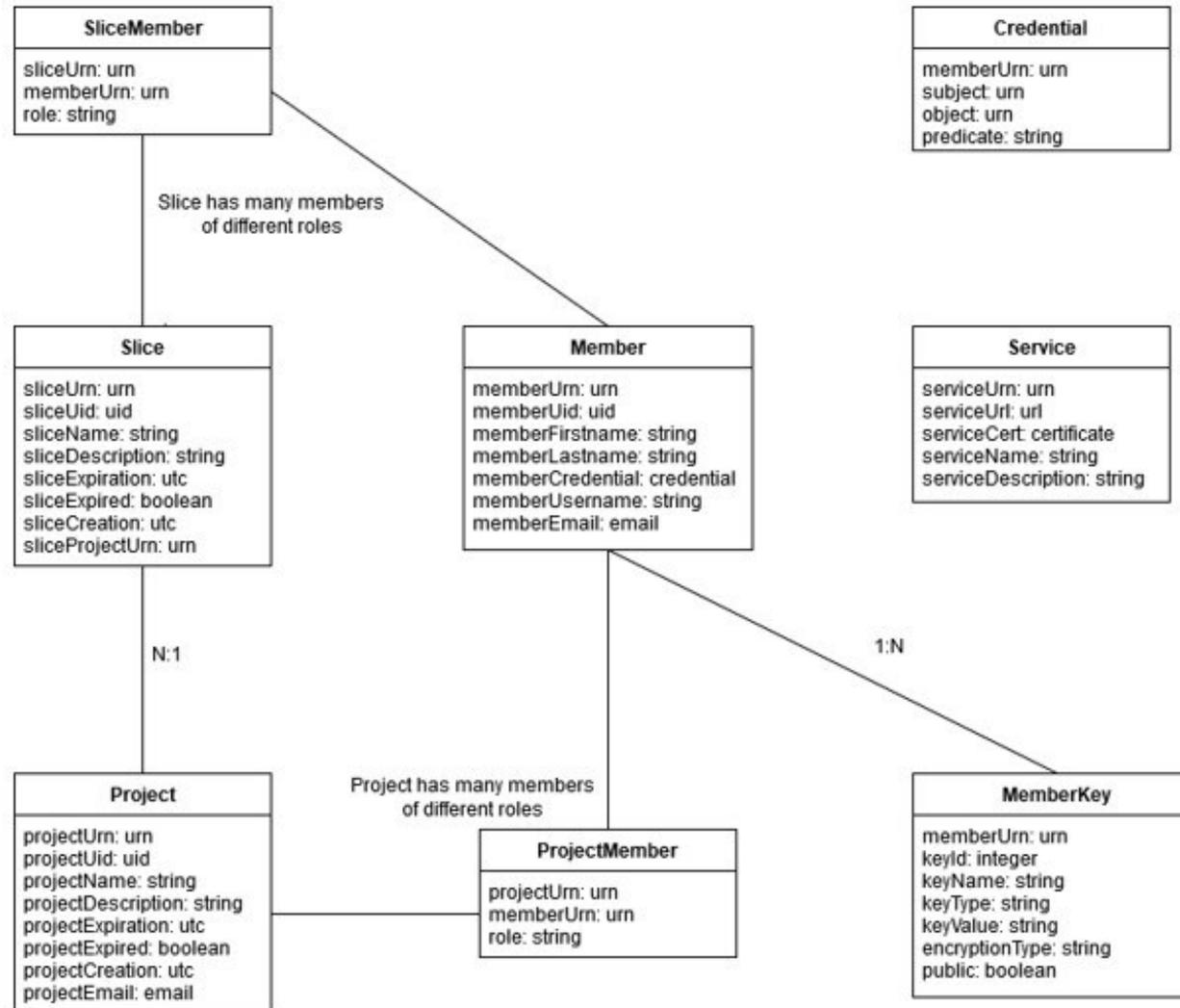


Potential of Testbed Interoperability and Federation

General architecture



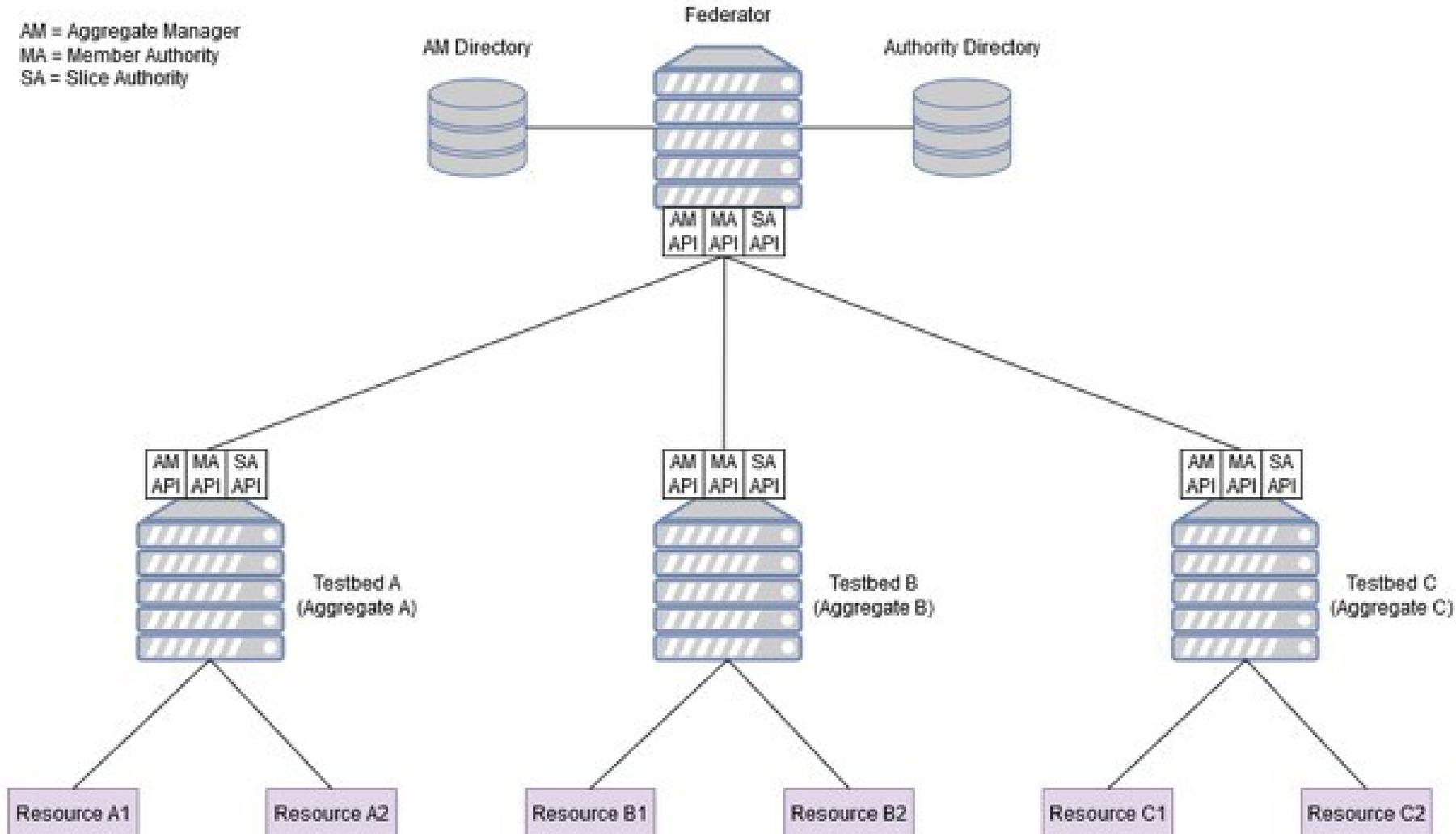
Proposed Elements of a Reference Model of Testbed Federation



Testbeds Federation APIs Requirements

- Management of the testbeds and their resources.
- Data encryption.
- Authentication and authorization.
- Versioning of the APIs.
- Extensibility of the APIs.
- Unique identifiers used across the APIs.
- Standardized communication protocol.
- Scalability.
- Etc.

Some APIs for Illustration of an Instantiation of the Generic Model



Some APIs for Illustration of an Instantiation of the Generic Model

- Mapping of the instantiation with the proposed generic reference model:
 - Federator = Universal Resource Broker
 - Aggregate Manager = Testbed Resource Broker
 - Aggregate Manager Directory = Real-Time Resources State Repository

Aggregate Manager (AM) API

| Method | Operation description | Parameters |
|---------------------------------|------------------------------------------------------------|---------------------------------------------------|
| <i>GetVersion</i> | <i>obtain the version of this API</i> | <i>options</i> |
| <i>ListResources</i> | <i>return the list of available resources in a testbed</i> | <i>credentials, options</i> |
| <i>Describe</i> | <i>provide the description of resources</i> | <i>urns, credentials, options</i> |
| <i>Allocate</i> | <i>reserves the resources</i> | <i>sliceUrn, credentials, rspec, options</i> |
| <i>Renew</i> | <i>extend the duration of a reservation</i> | <i>urns, credentials, expirationTime, options</i> |
| <i>Provision</i> | <i>provision resources</i> | <i>urns, credentials, options</i> |
| <i>Status</i> | <i>get the status of slivers</i> | <i>urns, credentials, options</i> |
| <i>PerformOperationalAction</i> | <i>perform an action on the slivers</i> | <i>urns, credentials, action, options</i> |
| <i>Delete</i> | <i>make the slivers unallocated</i> | <i>urns, credentials, options</i> |
| <i>Shutdown</i> | <i>shut down slivers</i> | <i>sliceUrn, credentials, options</i> |

Aggregate Manager (AM) API

- Creation of an experiment:
 1. Discover the resources (method ListResources).
 2. Request the resources through a reservation (method Allocate).
 3. Provision the reserved resources (method Provision).
 4. Start the resources (method PerformOperationalAction).
 5. Check the status of the resources started (method Status).
 6. Extend the reservation of the resources (method Renew).
 7. Free the resources after an experiment (method Delete).

Slice Authority (SA) API

| Method | Operation description | Parameters |
|-------------------------|-------------------------------------------------------------|----------------------------------------------|
| <i>Create</i> | <i>create a new slice or sliver or project</i> | <i>type, credentials, options</i> |
| <i>Update</i> | <i>update a slice or sliver or project</i> | <i>type, urn, credentials, options</i> |
| <i>Delete</i> | <i>delete a sliver</i> | <i>type, urn, credentials, options</i> |
| <i>Lookup</i> | <i>find slices or slivers or projects matching criteria</i> | <i>type, credentials, options</i> |
| <i>GetCredentials</i> | <i>provide the list of credentials</i> | <i>sliceUrn, credentials, options</i> |
| <i>ModifyMembership</i> | <i>modify the membership for a slice or project</i> | <i>type, urn, credentials, options</i> |
| <i>LookupMembers</i> | <i>find the members of a slice or project</i> | <i>type, urn, credentials, options</i> |
| <i>LookupForMember</i> | <i>get the slices or projects linked to a member</i> | <i>type, memberUrn, credentials, options</i> |

Member Authority (MA) API

| Method | Operation description | Parameters |
|-----------------------|-----------------------------------------------------------|----------------------------------------|
| <i>Create</i> | <i>create a record for a key associated with a member</i> | <i>type, credentials, options</i> |
| <i>Update</i> | <i>update the information of a member and his key</i> | <i>type, urn, credentials, options</i> |
| <i>Delete</i> | <i>delete the record for a key</i> | <i>type, urn, credentials, options</i> |
| <i>Lookup</i> | <i>find information of a given member and his key</i> | <i>type, credentials, options</i> |
| <i>GetCredentials</i> | <i>get the list of credentials for a member</i> | <i>memberUrn, credentials, options</i> |

Proposed Reference Metrics

- Detection of Internet disconnections.
- Packet loss and transmission errors.
- Energy consumption.
- Number of running virtual machines.
- CPU load.
- Free RAM.
- Number of simultaneous sessions.
- Number of refused service requests.
- Etc.

Appendixes

(not part of the Recommendation)

1. GENI testbed federation
2. Fed4FIRE+ testbed federation
3. Use case for a testbed federation
4. Use case for a federation of testbeds
5. Use case for federations of testbeds

Conclusion

- The Recommendation presented a set of open APIs for interoperable testbed federation offering these functionalities:
 - The management of the interconnection and the interoperability of testbeds in a federation.
 - The resources advertisement, allocation and provision.
 - The user management and the user roles.

Thank you !

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