

Software-as-a-Service The iPlant Foundation

API



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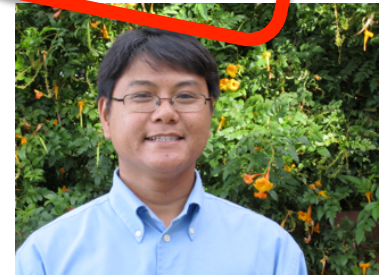
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Outline

- Why, why, why!
- When ducttape isn't enough
- Building an API for the web
- Core services
- Love, hate, and building user communities
- Future plans: Roadmap or Apple Maps?

Why, why, why!



iPlant Collaborative™ *Empowering A New Plant Biology*

iPlant is developing cyberinfrastructure that uniquely enables scientists throughout the diverse fields that comprise plant biology to address Grand Challenges in new ways, to stimulate and facilitate cross-disciplinary research, to promote biology and computer science research interactions, and to train the next generation of scientists on the use of cyberinfrastructure in research and education.

Why, why, why!

Lots of use cases, lots of users.

- Command line
- High performance
- High throughput
- Science gateways
- Big memory
- Big data
- Database driven
- Proprietary codes
- Public codes
- Workflows
- Long-running tasks
- Local hardware
- Web-based
- Long tail science
- Grand challenge
- Interactive

Why, why, why!

Lots of solutions deployed

- Atmosphere: private cloud
- Data Store: virtualized distributed storage
- Discovery Environment: rich web-based science gateway
- TNRS: resolution service to help researcher interact
- Semantic Web: data and service integration based on ontological definitions
- MyPlant: social media site

Why, why, why!

<http://www.iplantcollaborative.org/learn/calendar>

Lots of support given

- Community forums
- Training workshops
- Application porting and optimization
- Collaborative projects
- Pilot programs
- Seed funding

5 Seed projects

70 Publications

140 Collaborators

250 Workshops

420 Applications

7500 Users

Why, why, why!

- Despite all this, there was a clear need for access to the breadth of the iPlant cyberinfrastructure at an API layer.

When ducktape isn't enough

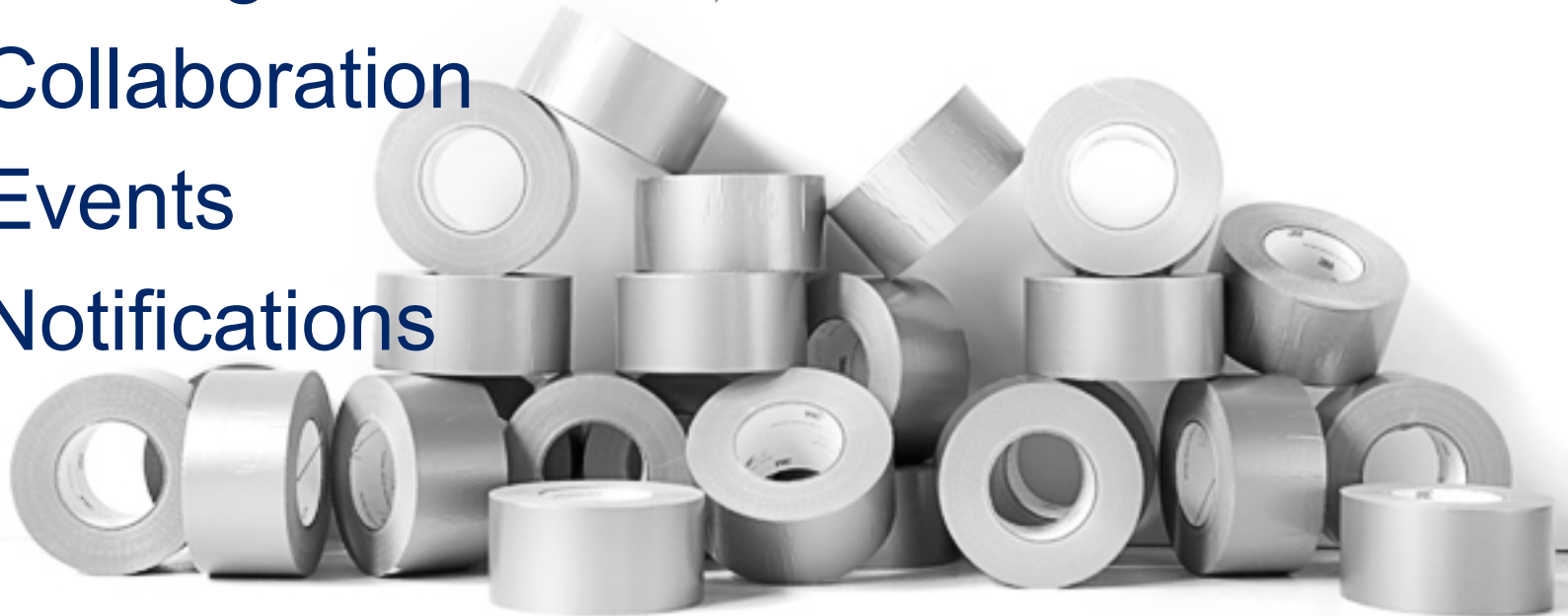


When duct tape isn't enough

- Great if solving for X or Y or Z
- Our users needed solutions for X & Y & Z
- Patching things together would actually make the end product more complicated
- Still doesn't address the missing pieces

When ducktape isn't enough

- ✘ Auth
- ✘ Accounting
- ✘ Sharing
- ✘ Collaboration
- ✘ Events
- ✘ Notifications
- ✘ Namespace
- ✘ Provenance
- ✘ *Common interfaces*



Building an API for the web

We started with a simple set of requirements from the community:

- Restful services
- Friendly URLs
- Abstract as many details as possible
- Should work the way the web works
- Encourage good citizenship
- Add value on top of existing services
- Comprehensive, not complete coverage

Building an API for the web

“We are more alike than we are different”

- HTTP
- SSL
- Basic Auth
- JSON
- XML
- Webhooks

Building an API for the web

Setting expectations

- Web vs batch environments
- *big data* vs **BIG DATA**
- Shared environments
- Caching
- Transient systems
- Uncontrolled infrastructure

Building an API for the web

Meeting expectations

- Asynchronous and Synchronous endpoints
- Callbacks & notifications
- Multiple queues
- Preemptive monitoring
- Caching
- Elastic scaling

Core services

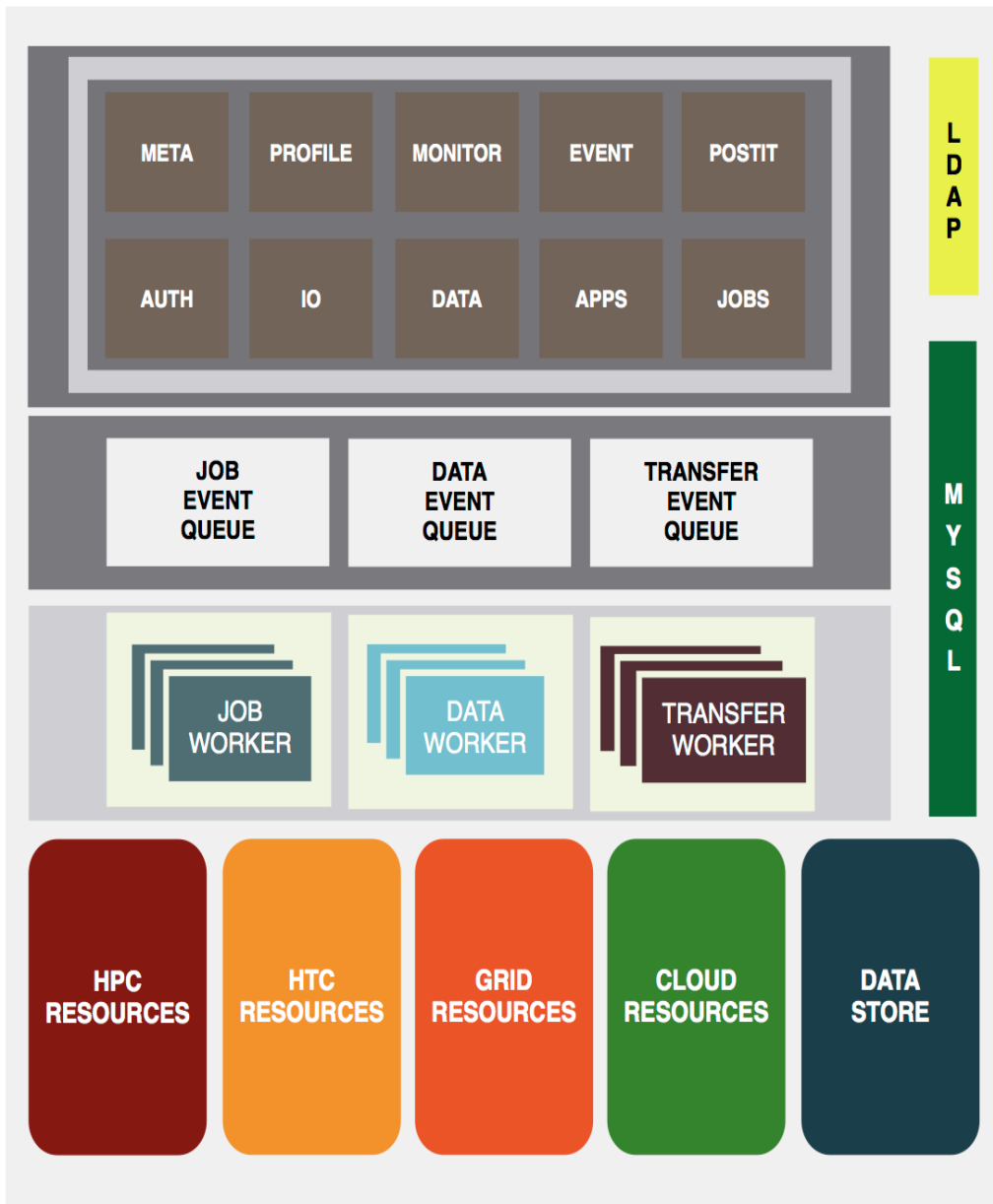
Production Services

-  Auth
-  Profile
-  IO
-  Data
-  Apps
-  Jobs
-  Postit

-  Audit
-  Systems
-  Monitor

Alpha Services

-  Env
-  Event
-  Mashup
-  Meta



Foundation API

<https://foundation.iplantcollaborative.org/auth-v1/>

Auth Service

/auth/

GET

Validates the username and password/token used to authenticate.

/auth-v1/

PUT

Renews the token used to authenticate for 2 hours.

/auth-v1/

DELETE

Expires the token used to authenticate.



Foundation API

<https://foundation.iplantcollaborative.org/auth-v1/>

Auth Service

`/auth/`

POST

Issues a token for a user. The tokens issued can be used interchangeably by the auth service and the rest of the Foundation API services just like actual user passwords.

`/auth/list`

GET

Returns JSON array with all active tokens for the authenticated user.



Foundation API

<https://foundation.iplantcollaborative.org/auth-v1/>

Auth Service Future

- Move towards full OAuth2 compliance
- Support delegated authentication decisions



Foundation API

<https://foundation.iplantcollaborative.org/profile-v1/>

Profile Service

```
/profile/
```

GET

Returns JSON description of the authenticated user profile

```
/profile/username/<username>
```

GET

Returns JSON description of the user with the given username

```
/profile/search/username/<username>
```

GET

Returns JSON array containing description of users with matching usernames



Foundation API

<https://foundation.iplantcollaborative.org/profile-v1/>

Profile Service

```
/profile/search/name/<name>
```

GET

Returns JSON array containing descriptions of the users matching name

```
/profile/search/email/<email>
```

GET

Returns JSON array containing description of users with matching email addresses.



Foundation API

<https://foundation.iplantcollaborative.org/profile-v1/>

Profile Service Future

- Move towards OpenID compliance
- Support CRUD operations
- Support sandboxed identity management



Foundation API

<https://foundation.iplantcollaborative.org/io-v1/>

IO Service

```
/io/list/<username>/<path>
```

GET

Returns JSON array containing description of the file/folder referenced by <path>

```
/io/<username>/<path>
```

GET, POST, DELETE, PUT

Performs operations on files and folders

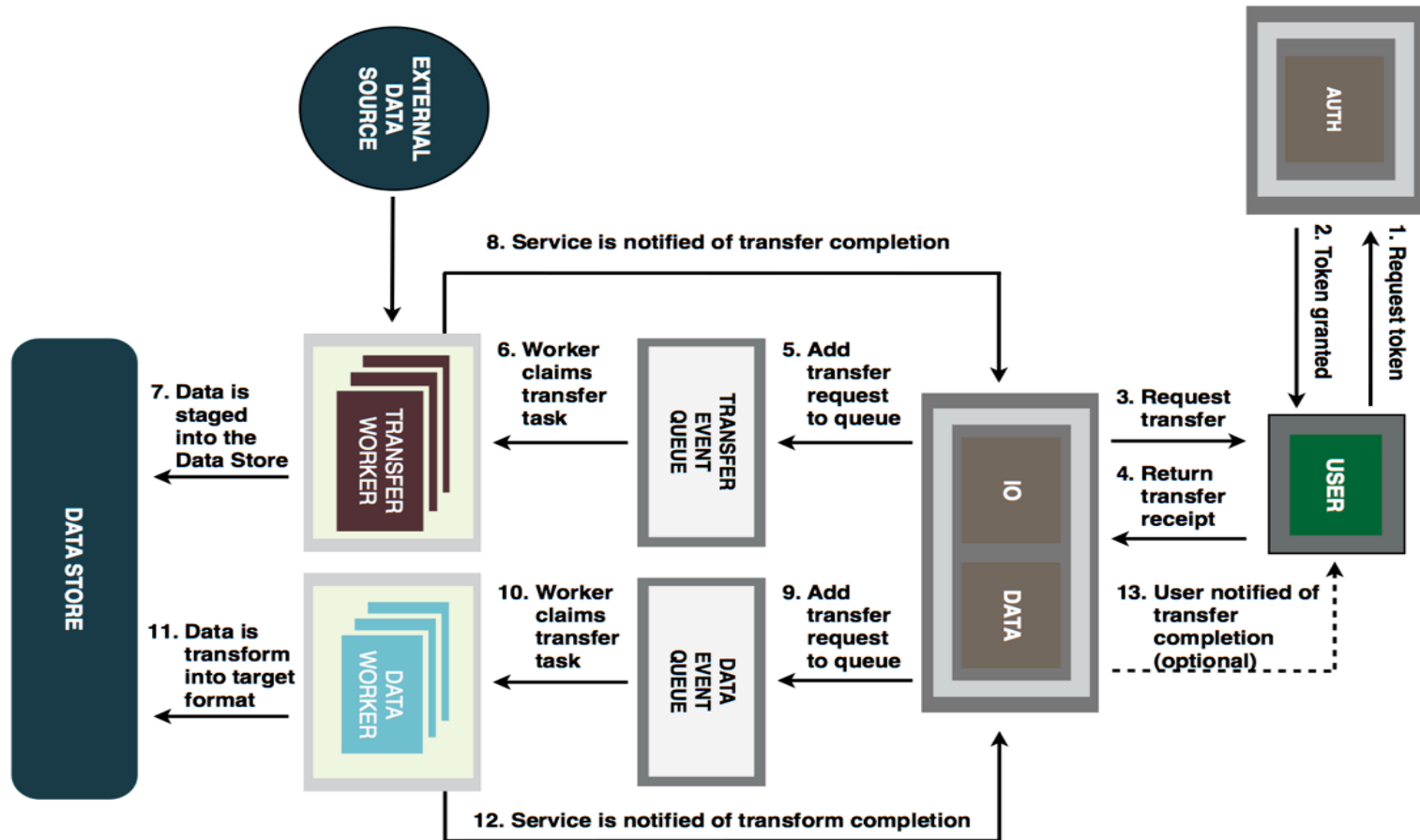
```
/io/share/<username>/<path>
```

GET, POST

Performs operations on file and folder share permissions



Foundation API



Foundation API

<https://foundation.iplantcollaborative.org/io-v1/>

IO Service Future

- Separate out generic staging functionality into a separate service
- Improve partial data queries
- Support user-defined systems



Foundation API

<https://foundation.iplantcollaborative.org/io-v1/>

Data Service

```
/data/transforms
```

GET

Returns JSON list of all available transforms

```
/data/transforms/<username>/<path>
```

GET

Returns JSON list of available transforms for a specific file

```
/data/transform/<transform_name>
```

GET

Returns JSON description of the transform



Foundation API

<https://foundation.iplantcollaborative.org/io-v1/>

Data Service

```
/data/tag/<tag_name>
```

GET

Returns JSON list of transforms tagged with the given term

```
/data/async/transform/<transform_name>/<username>/  
<path>
```

POST

Returns the file transformed from its original format to the named format and staged to a location defined by the user.

```
/data/sync/transform/<transform_name>/<username>/  
<path>
```

GET

Returns the file transformed into the named format.



Foundation API

<https://foundation.iplantcollaborative.org/io-v1/>

Data Service Future

- Improve partial data queries



Foundation API

<https://foundation.iplantcollaborative.org/apps-v1/>

Apps Service

`/apps`

POST

Add or update an app you own by posting an app description file

`/apps/list`

GET

Returns JSON array containing a list of all public apps

`/apps/shares/list`

GET

Returns JSON array containing a list of all your public and shared apps



Foundation API

<https://foundation.iplantcollaborative.org/apps-v1/>

Apps Service

```
/apps/<app_id>
```

GET, POST, PUT, DELETE

Manage the specified app.

```
/apps/[name|tag|term]/<value>
```

GET

Search for applications by the given field and value

```
/apps/list
```

GET

Returns a JSON array of applications



Foundation API

<https://foundation.iplantcollaborative.org/apps-v1/>

Apps Service

```
/apps/shared/<app_id>
```

GET

Returns a JSON array of the user's private and shared apps

```
/apps/shared/[name|tag|term]/<value>
```

GET

Search for private and shared applications by the given field and value

```
/apps/shared/list
```

GET

Returns a list of private and shared apps.



Foundation API

<https://foundation.iplantcollaborative.org/apps-v1/>

Apps Service

```
/apps/<app_id>/share
```

GET, POST, DELETE

Manages ACL for the given application

```
/apps/<app_id>/form
```

GET

Generates a HTML form that can be used to submit a job for the given app

```
/apps/
```

POST

Register, update an application



Foundation API

<https://foundation.iplantcollaborative.org/io-v1/>

Apps Service Future

- Support cloning of apps.
- Make app publication easier.
- Support different application execution types
- Support different execution platforms
- Better support for individual environment setups.



Foundation API

<https://foundation.iplantcollaborative.org/apps-v1/>

Systems Service

```
/systems/list
```

GET

Returns JSON array containing descriptions of all available iPlant execution systems

```
/systems/list/<resource_id>
```

GET

Returns JSON description of the given system. Resource_id is XSEDED IIS ResourceID



Foundation API

<https://foundation.iplantcollaborative.org/io-v1/>

Systems Service Future

- Better monitoring
- POST method for updating
- Support registering of private systems
- Support convenience endpoints for status, etc.
- KBase integration



Foundation API

<https://foundation.iplantcollaborative.org/monitor-v1/>

Monitor Service

```
/monitor/<yyyy-mm-dd>
```

GET

Return JSON array of daily monitoring results

```
/monitor/service/<service_id>/<yyyy-mm-dd>
```

GET

Returns JSON array of daily monitoring results for a service

```
/monitor/suite/<service_id>/<yyyy-mm-dd>
```

GET

Returns JSON array of daily monitoring results for a suite

```
/monitor/test/<test_id>
```

GET

Returns JSON representation of a specific test



Foundation API

<https://foundation.iplantcollaborative.org/io-v1/>

Monitor Service Future

- Deeper testing of individual systems
- Add networking tests
- Ramp up testing frequency when possible
- Add application and data movement tests



Foundation API

<https://foundation.iplantcollaborative.org/apps-v1/>

Job Service

`/job`

POST

Submit a job request

`/job/<job_id>`

GET, POST, DELETE

Query for information, resubmit, or delete a job

`/job/<job_id>/share`

GET, POST, DELETE

Manage job share permissions



Foundation API

<https://foundation.iplantcollaborative.org/apps-v1/>

Job Service

```
/job/<job_id>/input
```

GET

Returns JSON array containing descriptions of the inputs for the job

```
/job/<job_id>/output/list/<path>
```

GET

Returns JSON array of job output files (similar to IO, but unique to the job)

```
/job/<job_id>/output/<path>
```

GET, POST

Downloads the file at the given path relative to the job's output folder



Foundation API

<https://foundation.iplantcollaborative.org/apps-v1/>

Job Service

```
/job/list/[<attribute>/<value>]+
```

GET

Searches for jobs by one or more attribute value combinations

```
/job/<job_id>/<attribute>
```

GET

Returns JSON array of jobs with only the job id and specified attribute



Foundation API

<https://foundation.iplantcollaborative.org/apps-v1/>

Job Service

```
/jobs/list
```

GET

Returns JSON array containing user jobs



Foundation API

<https://foundation.iplantcollaborative.org/io-v1/>

Job Service Future

- Add support for OSG, multi-cloud, FutureGrid, and user-defined systems
- Support CLI apps
- Support submissions run under individual user accounts
- Support arbitrary archiving locations
- Improve rate limiting, provenance, and data movement efficiencies
- Implement a charging models
- KBase integration



Foundation API

<https://foundation.iplantcollaborative.org/postit-v1/>

Postit Service

`/postit/`

GET

Creates a disposable url with built in authentication. Returns JSON array containing postit url and lifetime information

`/postit/<nonce>`

GET

Invokes the url registered to this postit with the registered method. Any form data passed in to this PostIt is forwarded, as appropriate, to the registered target.

`/postit/<nonce>`

DELETE

Revokes the specified PostIt immediately.



Foundation API

<https://foundation.iplantcollaborative.org/io-v1/>

PostIt Service Future

- Expand as more general authenticated url shortening service.



Foundation API

<https://foundation.iplantcollaborative.org/audit-v1/>

Audit Service

```
/audit/
```

GET

Returns JSON array containing job, iPlant Data Store, and Atmosphere usage information.

```
/audit/<job,data,atmo>
```

GET

Returns JSON object containing the specified form of usage information



Foundation API

<https://foundation.iplantcollaborative.org/audit-v1/>

Audit Service Future

- Add better support for Atmosphere accounting
- Add data movement analytics



Foundation API

<https://foundation.iplantcollaborative.org/event-v1/>

Event Service

`/event/`

GET, POST

Register a new event or get a snapshot of all your registered events

`/event/<event_id>`

GET, POST, DELETE

Manage an event

`/event/<event_id>/subscriptions`

GET, POST

List and create subscriptions.



Foundation API

<https://foundation.iplantcollaborative.org/event-v1/>

Event Service

```
/event/<event_id>/subscriptions/<sub_id>
```

GET, POST, DELETE

Manage an existing subscription.



Foundation API

<https://foundation.iplantcollaborative.org/event-v1/>

Event Service Future

- Integrate directly with underlying messaging services
- Incorporate global IDs into registration requests
- Integrate API events as first class events in service



Still to come...

Meta Service

`/meta/`

POST

Create a new metadata item

`/meta/<meta_id>`

GET, POST, DELETE

Manage metadata item

`/meta/schema`

GET, POST

Returns a JSON array of schemas registered with the Service. Create a new schema.



Still to come...

Meta Service

```
/meta/schema/<schema_id>
```

GET, POST, DELETE

Manage a metadata schema

```
/meta/map
```

POST

Returns a JSON Array of metadata schema maps registered with the service. Create a new metadata map between schemas.

```
/meta/map/<meta_id>
```

GET, POST, DELETE

Manage a metadata schema



Still to come...

Meta Service Future

- Improve scalability
- Explore better ways to translate between schemas
- Directly support ontology overlays
- Integrate tightly with the other API services



Still to come...

Mashup Service

`/mashup-v1/`

POST

Submit a mashup for execution

`/mashup-v1/<mashup_id>`

GET, POST, DELETE

Returns JSON descriptions of a specific mashup

`/mashup-v1/list`

GET

Returns a list of JSON descriptions of your mashups



Still to come...

Mashup Service

`/mashup/tags/<tag>`

GET

Search for mashups by tag

`/mashup/share/<mashup_id>`

GET, POST, DELETE

Manage share permissions on a specific mashup

`/mashup/share/<mashup_id>`

POST, DELETE

Performs operations on job share permissions



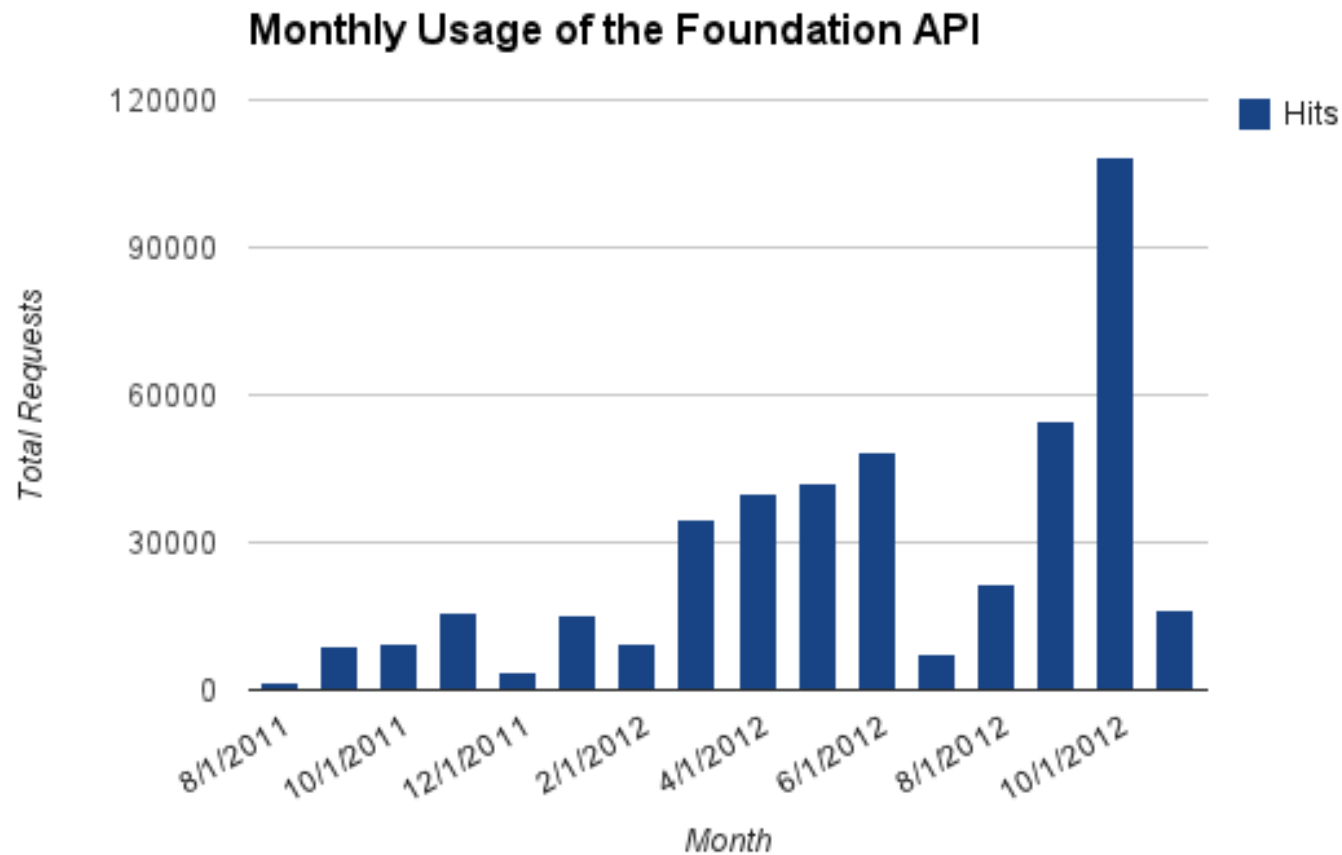
Still to come...

Env Service

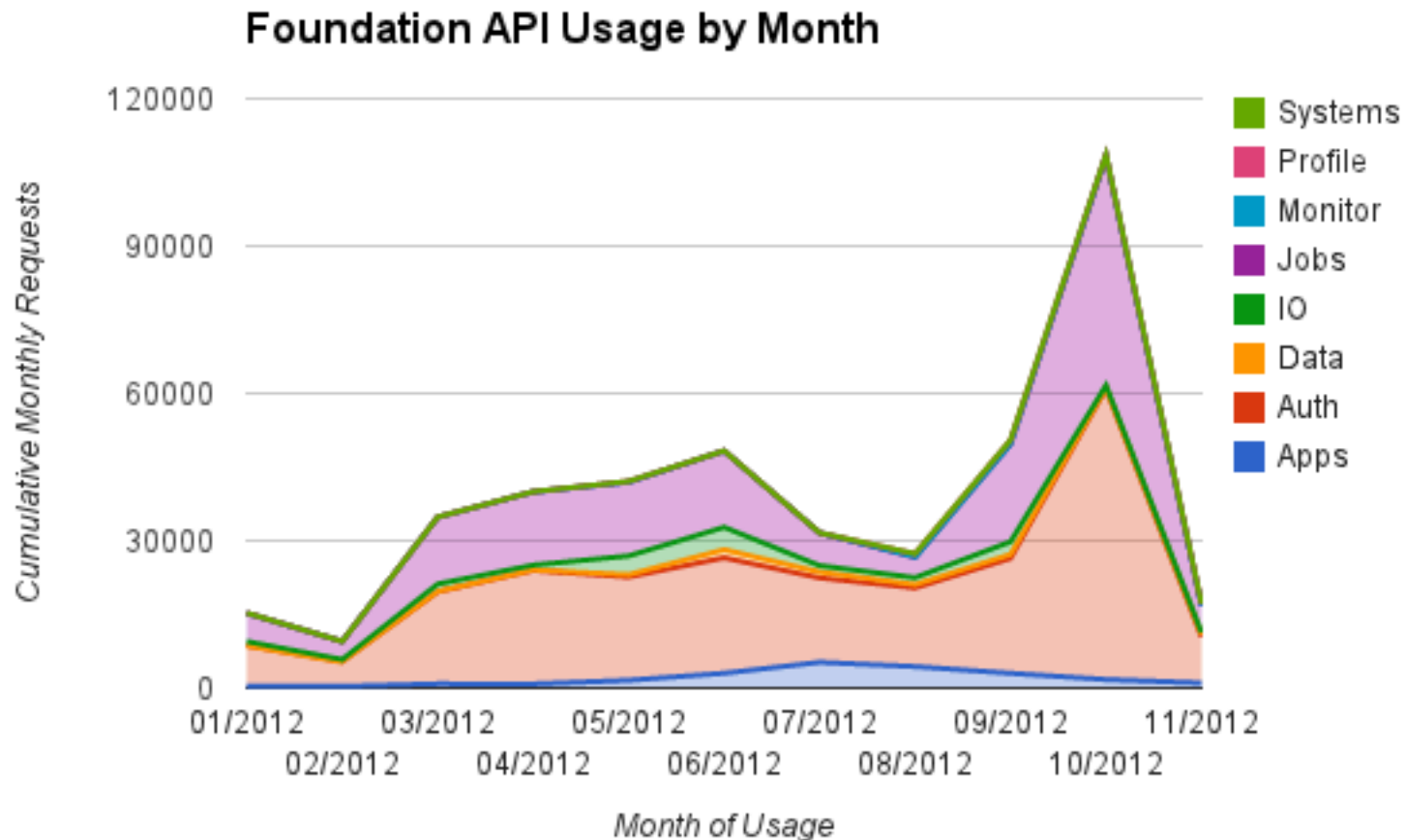
- Still thinking through this service
- Primarily needed when we support individual system registration.
- Will handle user environment management
- Update, query user environment
- Full module support
- Discovery endpoints
- Migration endpoints



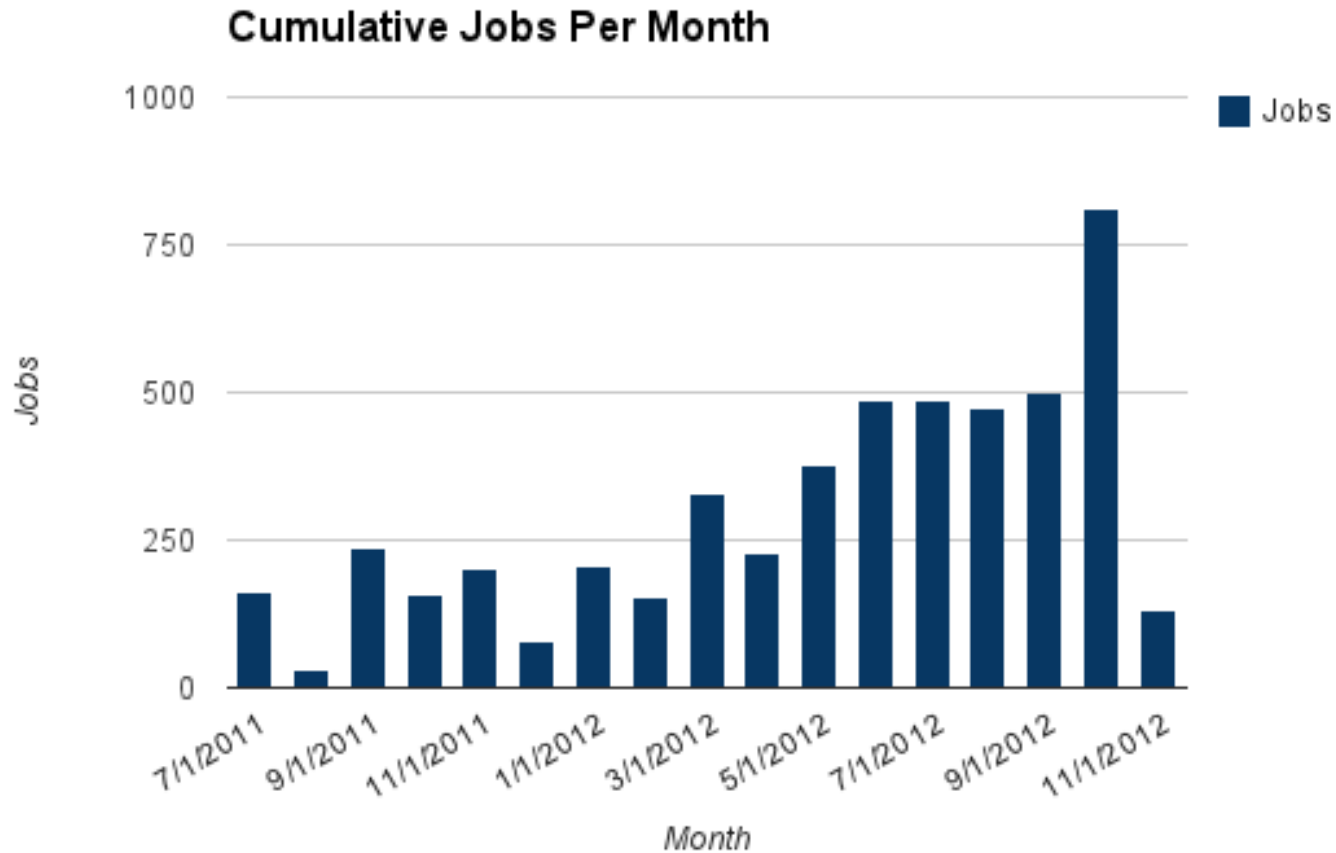
Love, hate, and building user communities



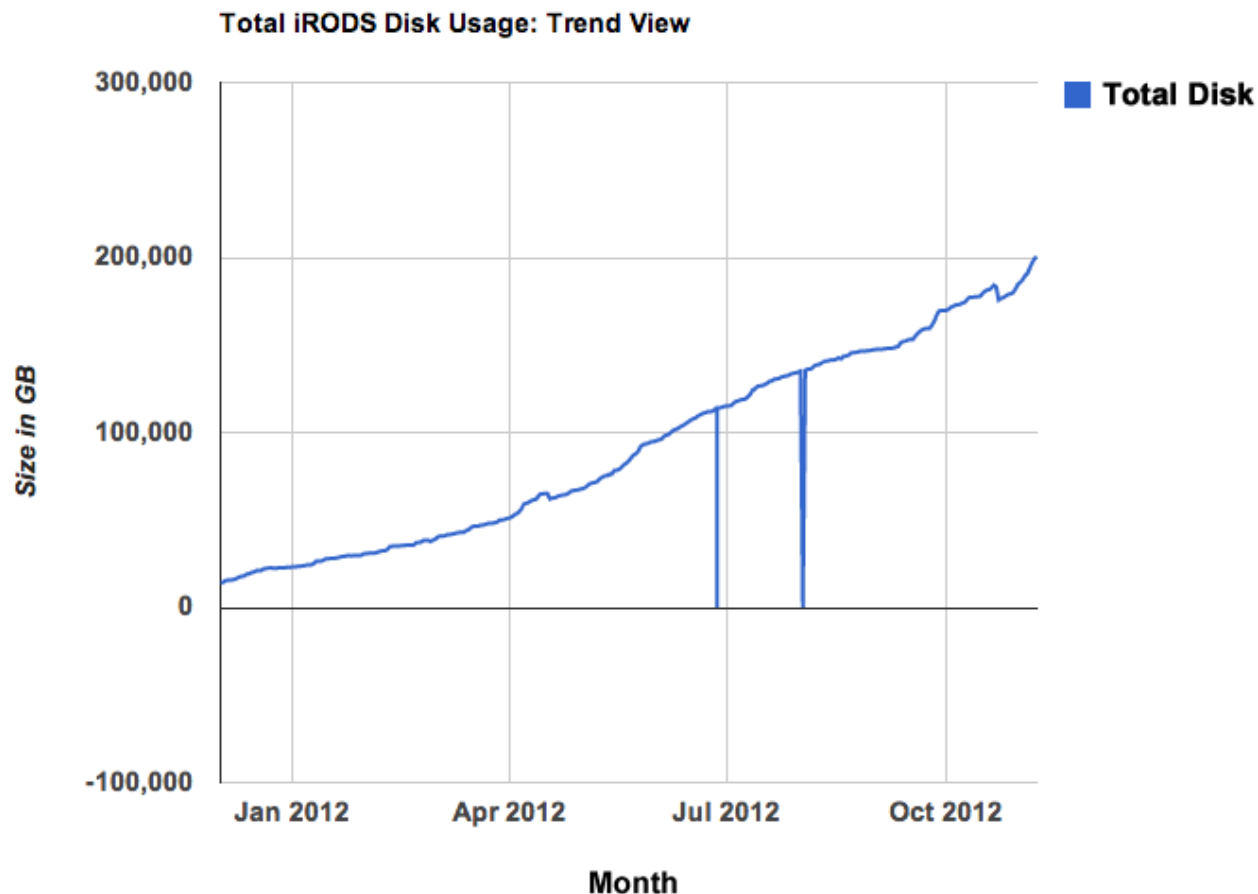
Love, hate, and building user communities



Love, hate, and building user communities



Love, hate, and building user communities



Things we've done well (thus far)

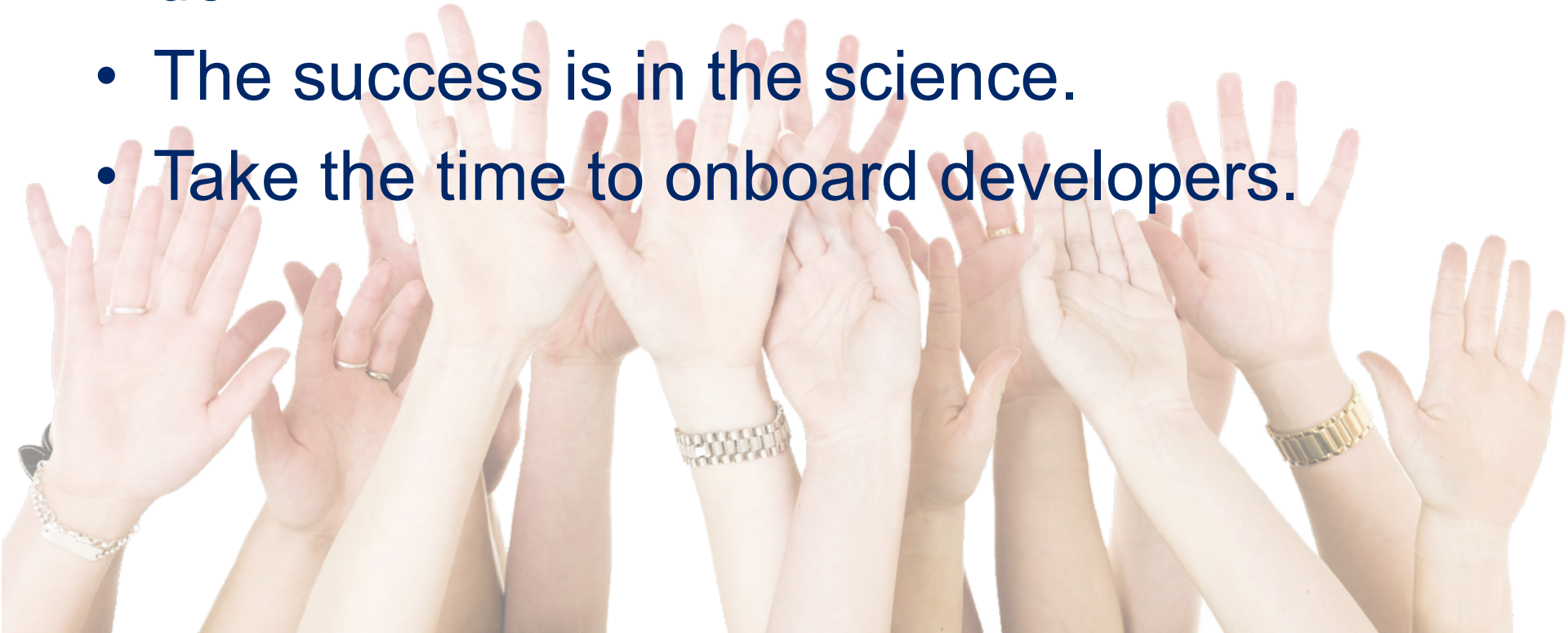
- Listened to our users
- Responded to user feedback,
- Implemented bug fixes, and feature requests quickly and openly
- Listened to our users
- Handled early scalability issues
- Documented the API, the concepts, and the process
- Kept our services running through down times
- Been preemptive about issues and updates

Teaching Points

- Address versioning early
- Be obsessive-compulsive about regression testing.
- Communicate with your users early and often.
- When dependencies go down, you look bad, so design with failovers in mind.
- Big data doesn't move well on the web. Set user expectations early and often. Don't be afraid to get creative and provide alternative solutions.

Teaching Points

- No one else thinks it's as simple as you do.
- The success is in the science.
- Take the time to onboard developers.



Future plans: Roadmap or Apple Maps?

- Don't build stuff just to build stuff
- Don't aim at nothing, you'll hit it every time
- Listen to our users. They're the only reason we're here.

Future plans: Roadmap or Apple Maps?

2.0 features release

- Global identifiers
- New HPC, HTC, Cloud, and private systems
- New application types
- 100's of new apps
- Performance improvements
- Stability improvements

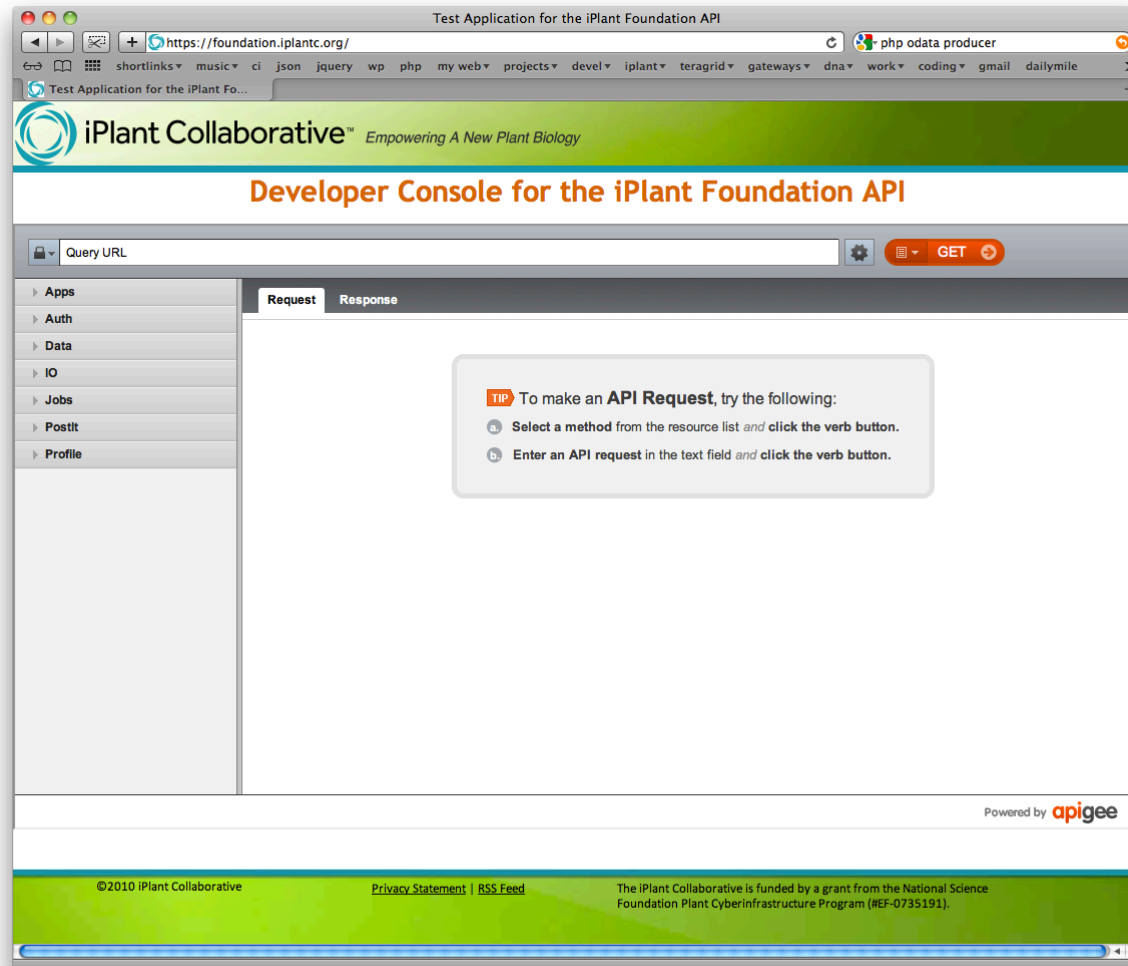
Future plans: Roadmap or Apple Maps?

New services

- OAuth2: fully compliant with current spec
- Staging service: from anywhere to anywhere using any protocol
- Metadata: deep metadata support for the entire enterprise
- Mashup: store and share workflows

Developer's Console

<https://foundation.iplantcollaborative.org/>



Demo App

<https://foundation.iplantcollaborative.org/iplant-test>

The screenshot shows a web browser window titled "Test Application for the iPlant Foundation API". The address bar contains the URL "https://foundation.iplantc.org/iplant-test/". The page header features the iPlant Collaborative logo and the tagline "Empowering A New Plant Biology". Below the header, the main content area is titled "Test Application for the iPlant Foundation API" and displays a REST client interface for the endpoint "GET: /io-v1/data/transforms". The interface includes a list of service endpoints:

- ▶ Auth Service - Login
- ▶ Auth Service - View Tokens
- ▶ Auth Service - Manage Tokens
- ▶ IO Service - File Browsing
- ▶ IO Service - File Upload
- ▶ Data Service
- ▶ Profile Service
- ▶ Apps Service
- ▶ Job Service

The footer contains the following information:

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More Info

<http://iplantcollaborative.org>

<https://foundation.iplantcollaborative.org/docs>

<https://foundation.iplantcollaborative.org/forums>

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