

# Demo: Developing Apps to Extend Open OnDemand

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**Abstract:** *The Open OnDemand Project is an open-source software project that enables high-performance computing (HPC) centers to install and deploy advanced web and graphical interfaces for their users. We have seen OnDemand's bundled applications significantly lower the barrier to entry for novice users. In addition, OnDemand can be easily extended for a given user community through the development of custom applications. In this demonstration, we show the creation, development and deployment of a simple example application.*

## 1. Introduction

Open OnDemand [1,2] is a web platform providing users integrated access to HPC systems, web applications and Virtual Network Computing (VNC) services. OnDemand is bundled with a set of web-based accessibility applications (or “apps”) for file browsing and editing, job submission and monitoring, and cluster login node access via a terminal. Last year we published a paper on Open OnDemand at XSEDE16 in July 2016 [2] describing the first year's work. Since then, we've transitioned OSC to the new platform, published all of the source code on GitHub, built a documentation website with detailed installation directions, added Slurm, LSF, and PBSPro support alongside Torque, hosted three webinars garnering interest from over 30 institutions, assisted multiple sites external to OSC with the installation of OnDemand, and added app development support.

Open OnDemand's initial adoption has been encouraging and a number of centers have begun OnDemand rollouts to their users. However, we believe the OnDemand experience can be much more than just the bundled apps. In fact, the bundled apps are just examples that leverage Open OnDemand's underlying platform for app creation

and hosting. Open OnDemand can host workflow-based web apps that submit batch jobs (like many science gateways) including interactive apps providing VNC access.

A common scenario at HPC centers involves users accessing GUI applications through a remote VNC session. Open OnDemand supports this through a web interface to VNC applications running on compute nodes launched from within a batch job. These are known as *interactive apps*.

After logging in, the user is first presented with the Dashboard app. The Dashboard is a navigational aid to discover and launch other apps. Users can select the Interactive Apps view, where they can launch apps such as Ansys, Abaqus, COMSOL, and Paraview (see Fig. 1) and, from there, create and connect to interactive sessions for each app.

For our tutorial, we will create a MATLAB interactive app and deploy it to the Dashboard. This tutorial assumes that you have a working Open OnDemand installation at your center and that your cluster is capable of launching MATLAB.

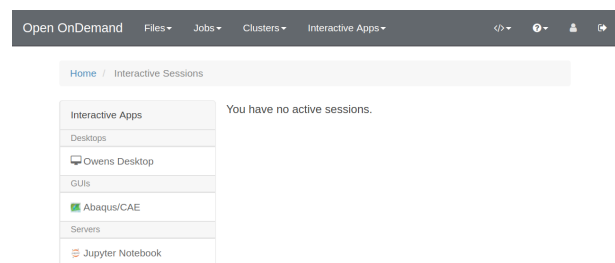


Figure 1: Dashboard without MATLAB app

## 2. App Creation

If enabled, the developer menu from the

Dashboard allows Open OnDemand developers to create and customize apps. User-local storage for apps is referred to as that developer’s Sandbox and is by default located in the developer’s home directory at `~/ondemand/dev`. When creating a new app, the developer is presented with the option to clone an existing app from a Git repository (see Fig. 2).

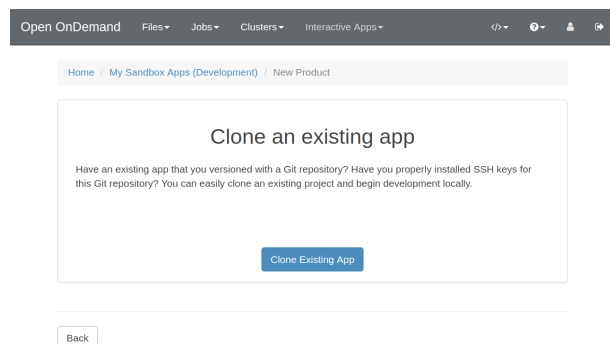


Figure 2: Create or copy a new app

After clicking “Clone Existing App” the developer is presented with a web form to specify the Git remote repository to clone, the name of the directory to clone to, and whether or not to retain the Git history. This gives the option to the developer to further develop an existing app or build a new app from a pre-existing app. If the developer chooses to omit the Git history, an empty Git repository will be created for versioning purposes. Checking the app into a new Git repository is standard practice, but left to the developer’s discretion.

### 3. App Development

The developer is then presented with the App Details view, which provides controls to update, launch, and delete the app (see Fig. 3).

The user can click the “Shell” and “Files” buttons to launch the Shell and Files apps respectively in the app directory for file editing, file uploading and command line access. Clicking “Edit” presents the user a web form to edit the app’s metadata: title, description, and Git remote repository. Clicking the “Launch ...” button

launches the app in a new browser tab. Clicking “Delete App” will remove the app directory.

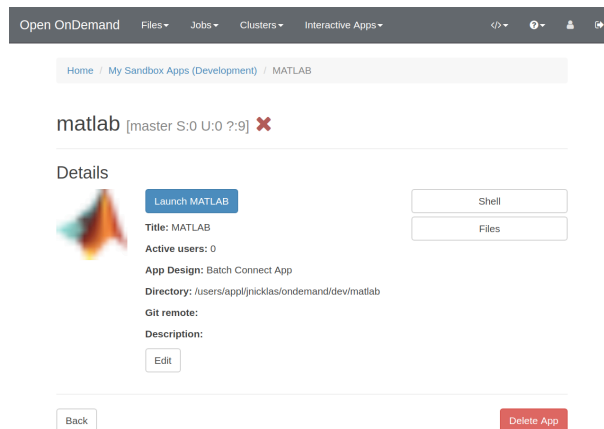


Figure 3: Sandbox app details

In Fig. 3 the developer copied an example app and chose to omit the Git history. The developer also updated the icon, title and modified the job template to launch MATLAB within the batch job. Clicking the “Launch MATLAB” button launches the app in a new browser tab (see Fig. 4).

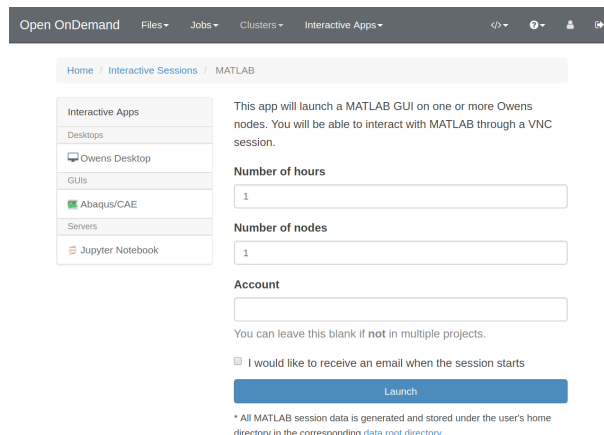


Figure 4: MATLAB Sandbox web app

The developer is presented with a web form to create a new interactive MATLAB session. Although the app list on the left shows all the production interactive apps that every user can access, this list does not include MATLAB because this app has not yet been deployed to production.

Pressing “Launch” will create a new interactive session, submitting a batch job in the

process. When the job is running, a connection button will appear in the session box (see Fig. 5).

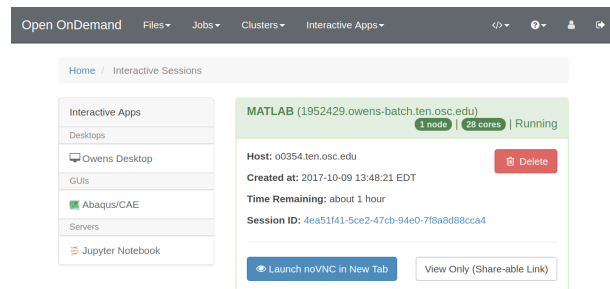


Figure 5: Web app showing MATLAB Session

The developer can connect to this running session using the noVNC client, an HTML5 VNC client. Clicking “Launch noVNC in New Tab” opens a new browser tab with MATLAB running in a VNC session on the compute node (see Fig. 6).

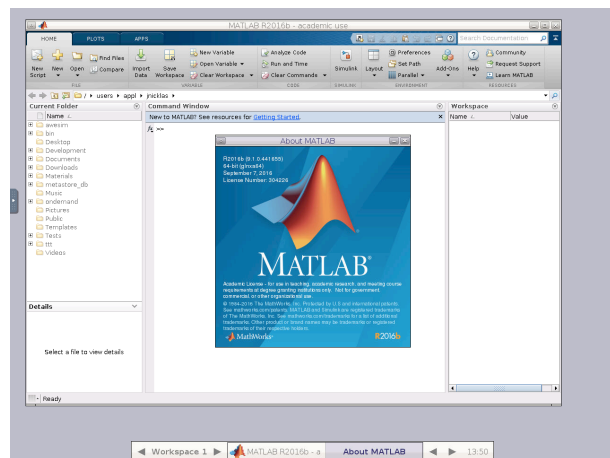


Figure 6: NoVNC Interactive MATLAB Session

The developer can continue to make updates and test the app until the app is ready for production. At this point it is common practice to version and tag a release of the code in a shared Git remote repository (e.g., GitHub, Bitbucket, GitLab, and etc.).

## 4. App Deployment

Apps can be deployed by the Open OnDemand administrator. Typically, this requires going to the

deployed apps directory and cloning the appropriate Git repository underneath it.

Continuing the previous example, the administrator deploys the MATLAB app by cloning a copy of the developer’s app to the production location. This by default is a directory under `/var/www/ood/apps/sys`. For plugin style Open OnDemand apps like MATLAB there is no build step required.

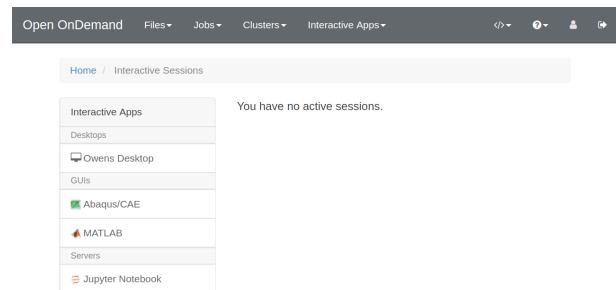


Figure 7: Dashboard showing MATLAB app

Once this copy is deployed, the MATLAB app will appear in the list of interactive apps and can be launched by all Open OnDemand users (see Fig. 7).

## 5. Conclusion

The MATLAB app example provided here was selected for its simplicity, allowing us to focus on the development workflow and the features of the platform (the Dashboard, the Sandbox and the App Detail view). That said, Open OnDemand can support applications written in a wide variety of web technologies. Open OnDemand includes Phusion Passenger, an application server that supports Ruby, Python, and Node.js web applications (<https://www.phusionpassenger.com>). By combining a friendly platform for novice users with a platform for app development and distribution, we hope Open OnDemand can transform access to HPC.

## 6. Acknowledgments

To find out more about Open OnDemand,

please see the main GitHub repo [3] and the promotional website [4]. The promotional website provides access to videos of past webinars and other information. The documentation provides installation directions and app development tutorials [5]. The ood-users mailing list is a source of discussions relevant to installation and app development [6].

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## 7. References

- [1] Hudak, D. E., Bitterman, T., Carey, P., Johnson, D., Franz, E., Brady, S., and Diwan, P. 2013. OSC OnDemand: a web platform integrating access to HPC systems, web and VNC applications. In *Proceedings of the Conference on Extreme Science and Engineering Discovery Environment: Gateway to Discovery*. (San Diego, CA, USA, July 22 - 25, 2013). XSEDE '13. ACM, New York, NY, 49, DOI=<http://dx.doi.org/10.1145/2484762.2484780>.
- [2] Hudak, D. E., Johnson, D., Nicklas, J., Franz, E., McMichael, B., and Gohar, B., P. 2016. Open OnDemand: Transforming Computational Science Through Omnidisciplinary Software Cyberinfrastructure. In *Proceedings of the XSEDE16 Conference on Diversity, Big Data, and Science at Scale*. (Miami, USA — July 17 - 21, 2016). XSEDE '16. ACM, New York, NY, 43, DOI=<https://dl.acm.org/citation.cfm?doid=2949550.2949644&preflayout=flat>
- [3] <https://github.com/OSC/Open-OnDemand>
- [4] <https://osc.github.io/Open-OnDemand>
- [5] <https://osc.github.io/ood-documentation/master/>
- [6] <https://lists.osu.edu/mailman/listinfo/ood-users>