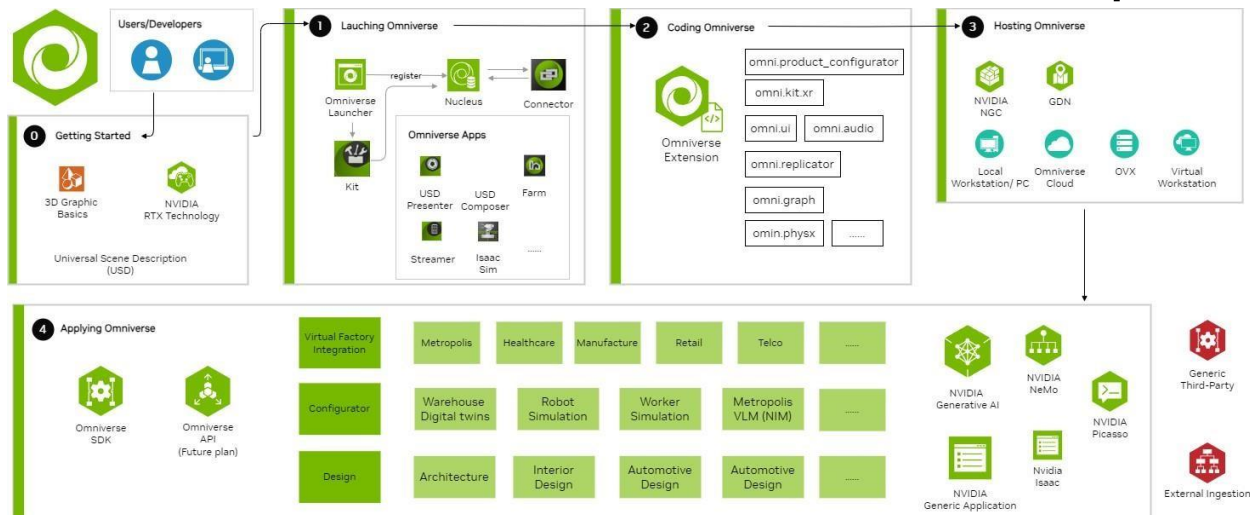


Learning Path for NVIDIA Omniverse Developers



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Overview

This learning guide provide curated list of content to help you get started with developing your own apps and extensions for NVIDIA Omniverse.

It is recommended that developers spend some time playing around with already built apps, based on Omniverse and get an idea of what technologies exist. A quick look through Omniverse Learning Path for End Users is advisable.

For developers on large teams working on specific components, who aren't concerned with the larger scope, this document would be an ideal starting point.

How to use this document

This document should be read / followed in order that documents / links are presented.

Entries will be marked as one of:

[Required] Overview with important concepts that should be read in its entirety.

[Tutorial] Optional Tutorial that will help with learning journey.

[Reference] This is here for reference when working on projects, and need not to be read end to end.

[Optional] Additional optional deeper dive reading on the topic, or other materials that may enhance the readers skills and knowledge. These may be visited at the same time as the rest of the module, or you may return to.

Study for Specific Use Cases and Moving Towards the Cloud sections are optional based off your own needs. Once you get there, you can pick and chose what modules matter to you, and in what order.

Documentation Location

Locations of commonly used documentation. This is your starting point for searches in the Nvidia Omniverse Docs.

[Omniverse Kit Overview](#)

Developing on Kit using Kit Template App Repo

This is the starting point of your journey, downloading, configuring, building, and then running your first app.

Prerequisites and requirements

Ensure your system is set up with the following to work with Omniverse Applications and Extensions:

Operating System: Windows 10/11 or Linux (Ubuntu 20.04/22.04 recommended)

- **GPU:** NVIDIA RTX capable GPU (Turing or newer recommended)
- **Driver:** Latest NVIDIA driver compatible with your GPU
- **Internet Access:** Required for downloading the Omniverse Kit SDK, extensions, and tools.

Required Software Dependencies

- **Git:** For version control and repository management
- **Git LFS:** For managing large files within the repository
- **(Windows) Microsoft Visual C++ Redistributable:** Many Windows systems will already have this, but if not, it can be obtained from [latest-supported-vc-redist](#)
- **(Linux) build-essentials:** A package that includes make and other essential tools for building applications. For Ubuntu, install with `sudo apt-get install build-essential`

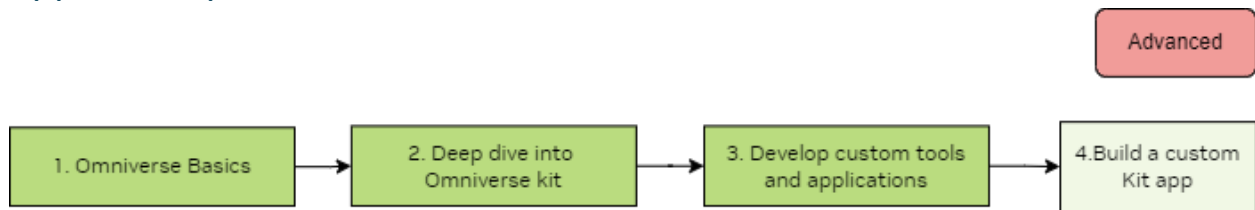
Recommended Software

- **(Linux) Docker:** For containerized development and deployment. **Ensure non-root users have Docker permissions.**
- **(Linux) NVIDIA Container Toolkit:** For GPU-accelerated containerized development and deployment. **Installation and Configuring Docker steps are required.**
- **VSCode** (or your preferred IDE): For code editing and development

Kit App Template

Name	Description	Source
GitHub - Omniverse Kit App Template [Required]	Toolkit designed for developers interested in GPU-accelerated application development within the NVIDIA Omniverse ecosystem.	GitHub
Omniverse Kit App Template Companion [Required]	This tutorial is designed for developers looking to gain a deeper understanding of creating applications within the NVIDIA Omniverse ecosystem using the Kit SDK.	Omniverse Doc

App Development with Omniverse Kit SDK



Name	Description	Source
NVIDIA Developing an Omniverse Kit-Based Application [Optional, you may have self-covered in last section]	The purpose of this course is to provide the basics for creating Omniverse applications. Using automated tools, you will create an application from a template and customize the functionality by adding extensions.	NVIDIA Deep Learning Institute
Omniverse Kit - Introduction [Optional]	Get an introduction to Omniverse Kit and learn how developers can leverage this powerful toolkit to create new Omniverse Apps and extensions.	NVIDIA On-Demand (Dec 2020)
Kit Overview [Required]	Navigate to the Exchange tab; Select Connectors; Choose a connector to install	Omniverse Doc

Using Kit

Some instructions on parts of kit you will need to use during your day to day development.

Name	Description	Source
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<u>Extensions Manager</u> [Required]	The Extensions Manager is responsible for loading and unloading extended capabilities in Omniverse Apps. The Search Bar allows users to search for extensions and the Types filter allows users to filter results based on extension type.	Omniverse Doc
<u>Kit Camera</u> [Optional]	This introduction to navigation covers the movement controls in Omniverse Kit-based application viewports. Developers will use the camera to move around their scene and observe how their app is functioning.	NVIDIA On-Demand (May 2021, Beginner)

Building an Extension

Name	Description	Source
<u>Extensions Overview</u> [Required]	Omniverse Extensions are the core building blocks of Omniverse Kit-based Apps. Extensions can be used to customize workflows and add functionality to Omniverse.	Omniverse Doc
<u>Getting Started with Extensions</u> [Required]	creating a new extension project and pushing the extension to a public git repository.	Omniverse Doc
<u>[Docs, latest] Kit C++ Extension Template</u> [Optional]	C++ Extension template for developers who will be using C++.	Omniverse Doc
<u>How to Build an Omniverse Extension in Less Than 10 Minutes (youtube.com)</u> [Tutorial]	Get to know who to easily create an Omniverse extension	NVIDIA YouTube (2022)

<u>Easily Develop Advanced 3D Layout Tools on NVIDIA Omniverse</u> [Tutorial]	<p>Get hands-on experience with NVIDIA Omniverse - the platform for connecting and creating physically accurate, 3D virtual worlds. See how easy it is to create your own custom scene layout tools in Omniverse Code with a few lines of Python script. In this self-paced course, you'll build your own custom scene layout in Omniverse with hands-on exercises in Omniverse Code and Python.</p>	<p>NVIDIA Deep Learning Institute</p>
<u>Build Beautiful, Custom UI for 3D Tools on NVIDIA Omniverse</u> [Tutorial]	<p>Experience the NVIDIA Omniverse development platform for builders and creators of virtual worlds. Become a master in UI with a deep dive into NVIDIA Omniverse Kit's powerful omni.ui suite of tools and frameworks. In this self-paced course you'll build your own custom UI for workflows in Omniverse with hands-on exercises.</p>	<p>NVIDIA Deep Learning Institute</p>
<u>How to Build Custom 3D Scene Manipulator Tools</u> [Tutorial]	<p>Python extension writing tutorial. Covers open use, sliders, widget manipulators.</p>	<p>NVIDIA Deep Learning Institute</p>
<u>Develop, Customize, and Publish in Omniverse With Extensions</u> [Tutorial]	<p>Python extension writing tutorial.</p> <ul style="list-style-type: none"> • Make a button to spawn a cube • Alter the Omniverse UI with custom windows 	<p>NVIDIA Deep Learning Institute</p>

	<ul style="list-style-type: none"> • Debug and an publish Extensions 	
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Additional Optional

How to Build Extensions and Apps for Virtual Worlds with NVIDIA Omniverse [Optional, General]	Learn how to create extensions and apps for virtual worlds using NVIDIA Omniverse. Discover the features and capabilities of NVIDIA Omniverse for virtual world development.	NVIDIA On-Demand (Sep 2022)
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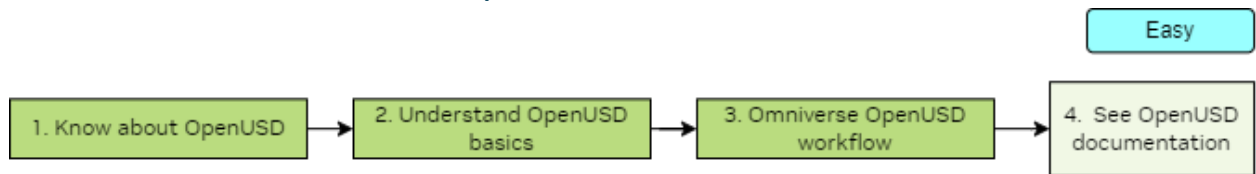
Core Functionality

UI

Name	Description	Source
Deep Dive into Omniverse Kit - OmniUI [Required]	This video introduces the OMNI.UI toolkit to build user interfaces for Omniverse Applications and Kit extensions.	NVIDIA On-Demand January 2021
Overview — Omniverse Kit UI Overview [Required]	The Omniverse UI Framework is the UI toolkit for creating beautiful and flexible graphical user interfaces in the Kit extensions. It provides a list of basic UI elements as well as a layout system which allow users to create a visually rich user interface.	Omniverse Doc

The Style Sheet Syntax [Reference]	omni.ui Style Sheet rules are almost identical to those of HTML CSS. It applies to the style of all omni ui elements.	Omniverse Doc
omni.ui Class Reference [Reference]	Reference for UI system classes	Omniverse Doc

Understand Omniverse USD Pipeline



Name	Description	Source
Introduction to USD [Required]	Learn what is OpenUSD, why use OpenUSD and what can use Do	OpenUSD Documentation
OpenUSD Overview [Required]	The videos below are a friendly introduction to the key features of OpenUSD that unlock countless possibilities for assembling, simulating, and collaborating in virtual worlds.	NVIDIA Docs Short videos
Getting Started with the Basics of OpenUSD Authoring and Querying [Required]	In this Universal Scene Description (OpenUSD) learning path, you will learn how to get started programmatically authoring and querying OpenUSD data in Kit.	Omniverse Documentation
Essentials of USD in Omniverse [Required]	Universal Scene Description (OpenUSD). In this hands-on training, we'll present what makes USD unique and the fundamentals for describing, composing, simulating, and collaborating within 3D worlds.. The hands-on portion of the training will utilize the USD Python API to experiment with the fundamental concepts of USD.	NVIDIA Deep Learning Institute
Getting Started with USD for Collaborate 3D Workflows [Optional]	In this self-paced course, participants will learn how to generate a scene using human-readable Universal Scene Description ASCII (.USDA) files.	NVIDIA Deep Learning Institute

OpenUSD In-Depth



Name	Description	Source
What Makes USD Unique [Required]	This video introduces Pixar's Universal Scene Description (USD) file format, explains its structure basics and introduces layers, references, and sublayers. We explore how larger scenes can be represented using these components.	NVIDIA On-Demand (Dec 2020)
Creating an Omniverse USD app from the Connect Sample	This video walks through how to set up USD and Omniverse Client Library dependencies and project settings from the Omniverse Connect Sample to create an application.	NVIDIA On-Demand
Workflow - Part 1: USD and Layers in Omniverse	covers USD and Layers to help understand how to leverage exporters best and how to edit USDA files to adjust parameters manually	NVIDIA On-Demand
Add Materials & Textures — Omniverse [Optional]	Materials in Omniverse are supported using MDL.	Omniverse Doc

Study for Specific Use Cases

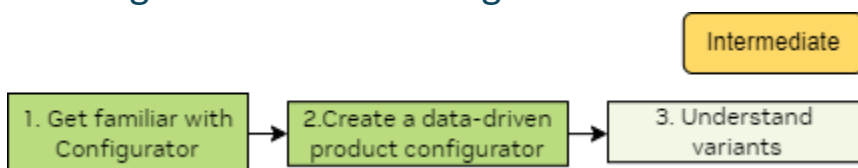
These can be worked through at whatever order makes sense for the given use case / project. Not all projects require all these components.

Connectors and Converters

OpenUSD Connections and Data Exchange, formerly Omniverse Connect, is a collection of [importers](#), [exporters](#), [converters](#), and [USD file format plug-ins](#) that enable various 3D applications, products, and file formats to exchange data using the Universal Scene Description

Name	Description	Source
USD Connections Overview		Omniverse Documentation
Omniverse Connect SDK — Omniverse Connect		Omniverse Documentation
Converters		Omniverse Documentation

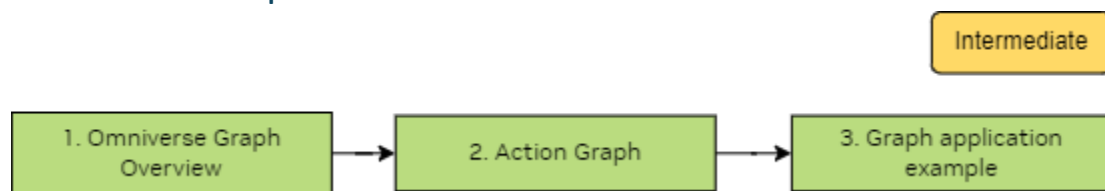
Working with Product Configurator



Name	Description	Source
Data Driven Product Configurators	This data driven approach to create product configurators can scale and support many different asset types.	Omniverse Documentation

Data Structure Tutorials	Below you will find a video series on how to set up data driven product configurations.	NVIDIA short video
Variant Editor	The Variant Editor provides an interface for adding, removing, and modifying variants in USD.	Omniverse Doc

Omniverse Graph Overview



Name	Description	Source
OmniGraph	OmniGraph is the visual scripting language of Omniverse. It allows the worlds in Omniverse to come alive with behavior and interactivity.	Omniverse Doc
Python Scripting	This tutorial will give a simple example of how to script an action graph using Python.	Omniverse Doc
Action Graph Quickstart	A quick start to use OmniGraph in Omniverse USD Composer to move a mesh in response to a key press.	Omniverse Doc
Create your own graph	Begin by opening the start USD file from the Python node Extension bundle so you have the necessary assets. Then, create a new Push Graph.	Omniverse Doc

Training ChatGPT on Omniverse Visual Scripting Using Prompt Engineering (youtube.com)	Experience with training #ChatGPT to create Omniverse Action Graph.	NVIDIA Youtube
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Omniverse XR

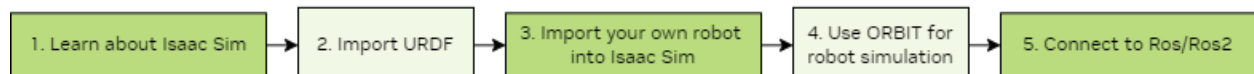
Name	Description	Source
NVIDIA Omniverse XR Overview NVIDIA On-Demand	With NVIDIA's Omniverse XR app, creators and developers can drop into 3D scenes in VR and AR with full RTX ray tracing.	NVIDIA On-Demand

Augmented Reality — Omniverse Extensions latest documentation (nvidia.com)	Augmented Reality in Omniverse is delivered through the use of CloudXR. CloudXR is set of AR/VR extensions which brings a powerful new way to view and interact with your Omniverse	Omniverse Documentation
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Developing Robot Applications with Omniverse and Isaac Sim

Isaac Sim is a robotics simulation toolkit for the NVIDIA Omniverse platform. It supports navigation and manipulation applications through ROS/ROS2. The documentation is divided into sections such as installation guide, API documentation, tutorials, and reference materials.

Advanced



Name	Description	Source
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What is Isaac Sim [Optional]	High level overview	YouTube (Oct 2021)
What Is Isaac Sim? [Required]	Overview	Omniverse Doc
Introduction to Robotic Simulations in Isaac Sim	Learn how to tap into the simulation loop of a 3D engine and initialize experiments with objects, robots, and physics logic using Isaac Sim Core.	NVIDIA Deep Learning Institute
How to Import Your Robot Into Isaac Sim in NVIDIA Omniverse	Import custom robots into Omniverse Isaac Sim work flow. Explore the potential of training and testing robots in a virtual simulation space.	NVIDIA YouTube (June 2021)
URDF Importer [Optional]	Starting from the Isaac Sim 2023.1.0 release, the URDF importer has been open sourced. Source code and information for contributing can be found at our GitHub repo	Omniverse Documentation
Isaac-sim/ IsaacLab: Repo	Isaac Lab is a unified and modular framework for robot learning that aims to simplify common workflows in robotics research	NVIDIA Github

ROS & ROS 2 Installation — Omniverse	Omniverse Isaac Sim provides a ROS and ROS 2 bridge for system integration. Isaac Sim runs a custom build of ROS NOETIC for the ROS bridge and is compatible with ROS 2 FOXY and HUMBLE for the ROS 2 bridge.	Omniverse Doc
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Synthetic Training Data Generation using Omniverse

SDG – Synthetic Data Generation.

Synthetic data in this context refers to computer generated data used to train Deep Learning models.

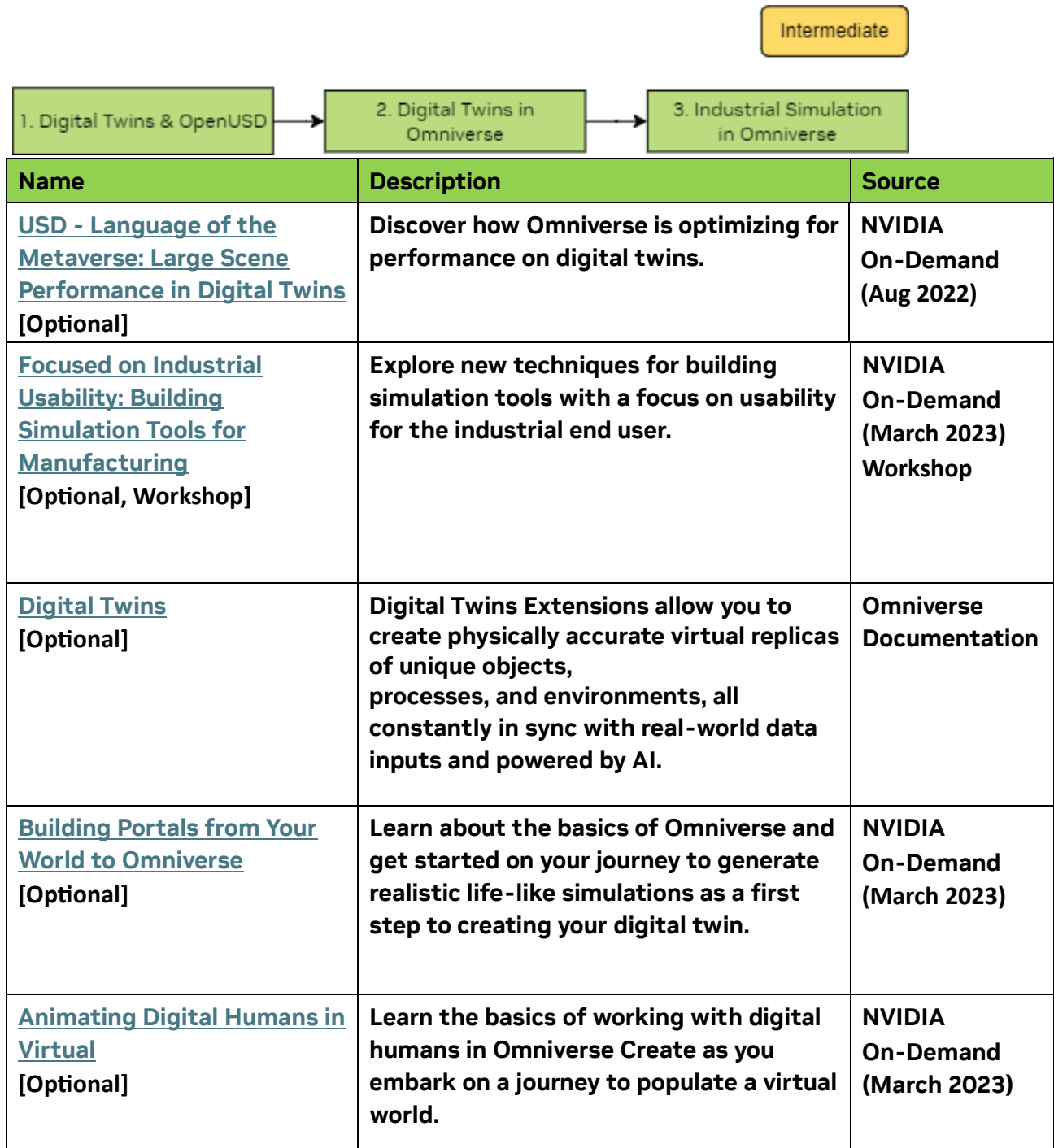
Omniverse Replicator augments costly, laborious human-labeled real-world data, which can be error prone and incomplete, with the ability to create large and diverse physically accurate data tailored to the needs of autonomous vehicle and robotics developers.

Develop custom synthetic data generation pipelines and services. Developers can generate physically accurate 3D synthetic data that serves as a valuable way to enhance the training and performance of AI perception

Name	Description	Source
Omniverse Replicator Intro [Optional]	High level intro to what synthetic data is, how it is generated and used with Omniverse.	NVIDIA YouTube (Oct 2022)
Generate Synthetic Data Using Omniverse Replicator for Perception Models [Optional]	A different version of above, either or both can be watched. Covers synthetic data and replicator. Recommended: first 30 minutes.	NVIDIA On-Demand March (2023)

<u>Replicator</u>	Overview of Replicator API	Omniverse Doc
<u>Synthetic Data Pipeline Part 1</u> <u>Synthetic Data Pipeline Part 2</u> <u>Synthetic Data Pipeline Part 3</u> [Optional]	How to record synthetic data in ISAAC Sim. Having access to large scale synthetic dataset helps in the training of deep learning applications. The Synthetic Data Recorder tool enables offline dataset generation of various synthetic data sensor output locally from multiple viewports.	NVIDIA YouTube (June 2021)
<u>Synthetic Data Generation for Training Computer Vision Models</u> [Optional]	This course uses a food manufacturing example to demonstrate the power of Omniverse Replicator synthetic data generation to train computer vision models.	NVIDIA Deep Learning Institute
<u>Synthetic Data Generation for Training Object Detection Models</u> [Optional]	Omniverse Replicator makes generating this 3D data streamlined in a single application, with the ability to modify the appearance and format of our data.	NVIDIA On-Demand (March 2023)

Develop a Virtual Factory and Digital Twin



Moving Towards the Cloud

Services

Name	Description	Source
Deep Dive into Omniverse Kit - Microservices	This video covers the Omniverse microservice architecture that allows developers to build and deploy applications made up of independent and modular components called services.	NVIDIA On-Demand (Jan 2021)

Omniverse Streaming

Name	Description	Source
Omniverse Streaming Extensions	Streaming interactive content to Users is an essential experience of any modern workflow, and Omniverse comes with a number of options out-of-the-box.	Omniverse Documentation
Omniverse Streaming Client	Omniverse Streaming Client is a lightweight application allowing Users to connect to Omniverse applications deployed on the network or over the Internet.	Omniverse Documentation
WebRTC Browser Client	By leveraging the new WebRTC live-streaming Extensions, it is now possible to stream any Omniverse application to web browsers.	Omniverse Documentation

Hardware for Omniverse

Name	Description	Source
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Omniverse Enterprise Systems NVIDIA [Optional]	NVIDIA RTX powered workstations enable real-time collaboration on design, visualization, and simulation projects.	NVIDIA Webpage
Scalable Data Center Infrastructure - OVX Systems NVIDIA [Optional]	NVIDIA Omniverse™ enables industrial digitalization applications. OVX offers high performance graphics and AI capabilities. Built on Omniverse, OVX supports 3D and simulation workflows.	NVIDIA Webpage
Omniverse Virtual Workstation [Optional]	Omniverse Virtual Workstation enables Enterprise users to create virtual machines with advanced RTX graphical capabilities. Cloud Service Providers (CSP) offer deployment options for the Omniverse Virtual Workstation.	Omniverse Doc
Virtual Workstation on Azure (Windows) [Optional]	An Omniverse Virtual Workstation on Microsoft Azure allows users to provision a Virtual Machine with graphical capabilities, eliminating the need for local RTX-enabled devices.	Omniverse Doc
Virtual Workstation on AWS (Windows) [Optional]	An Omniverse Virtual Workstation on AWS allows users to provision a Virtual Machine with graphical capabilities, eliminating the need for local RTX-enabled devices.	Omniverse Doc

Appendix

Useful NV Omniverse resources:

- [Nvidia Deep Learning Institute](#)
- [Latest Omniverse topics - NVIDIA Developer Forums](#)
- [Search | NVIDIA On-Demand](#)
- [NVIDIA Omniverse - YouTube](#)
- [Develop on NVIDIA Omniverse Platform | NVIDIA Developer](#)
- [NVIDIA Omniverse Doc](#)
- [Omniverse Discord](#)
- [NVIDIA Omniverse Community Livestreams - YouTube](#)
- [nvidia-learning-training-course-catalog.pdf](#)