

# UEFI & EDK II Training

## Platform Configuration Database (PCD)

[tianocore.org](https://tianocore.org)



# LESSON OBJECTIVE

- ★ Define Platform Configuration Database (PCD) and explain the syntax
- ★ Differentiate types of PCDs
- ★ Explain how changing a PCD value affects output
- ★ Evaluate the results of a PCD value modification
- ★ Special PCDs

# PCD OVERVIEW



# EDK II PCD's Purpose and Goals

 Documentaton : [MdeModulePkg/Universal/PCD/Dxe/Pcd.inf](https://github.com/tianocore/edk2/blob/master/MdeModulePkg/Universal/PCD/Dxe/Pcd.inf)

## Purpose

- Establishes platform common definitions
- Build-time/Run-time aspects
- Binary Editing Capabilities

## Goals

- Simplify porting
- Easy to associate with a module or platform



# EDK II PCD's Purpose and Goals

 Documentaton : [MdeModulePkg/Universal/PCD/Dxe/Pcd.inf](https://github.com/tianocore/edk2/blob/master/MdeModulePkg/Universal/PCD/Dxe/Pcd.inf)

```
////////////////////////////////////  
//                                                                    //  
//          Introduction of PCD database                             //  
//                                                                    //  
////////////////////////////////////
```

## 1, Introduction

PCD database hold all dynamic type PCD information. The structure of PEI PCD database is generated by build tools according to dynamic PCD usage for specified platform.

## 2, Dynamic Type PCD

Dynamic type PCD is used for the configuration/setting which value is determined dynamic. In contrast, the value of static type PCD (FeatureFlag, FixedPcd, PatchablePcd) is fixed in final generated FD image in build time.

See Link above to view the entire documentation

# PCD TYPES

**FixedAtBuild**

**Dynamic**

**PatchableInModule**

**DyanmicEx**

**DynamicHii**

**FeatureFlag**

**DynamicVpd**

## Syntax Examples

```
[pcdsFeatureFlag.common] [pcdsFixedAtBuild.IA32]  
[PcdsFixedAtBuild, PcdsPatchableInModule, PcdsDynamic,  
PcdsDynamicEx]
```





# UEFI Platform Initialization (PI) 1.x Spec & PCDs

## PEI

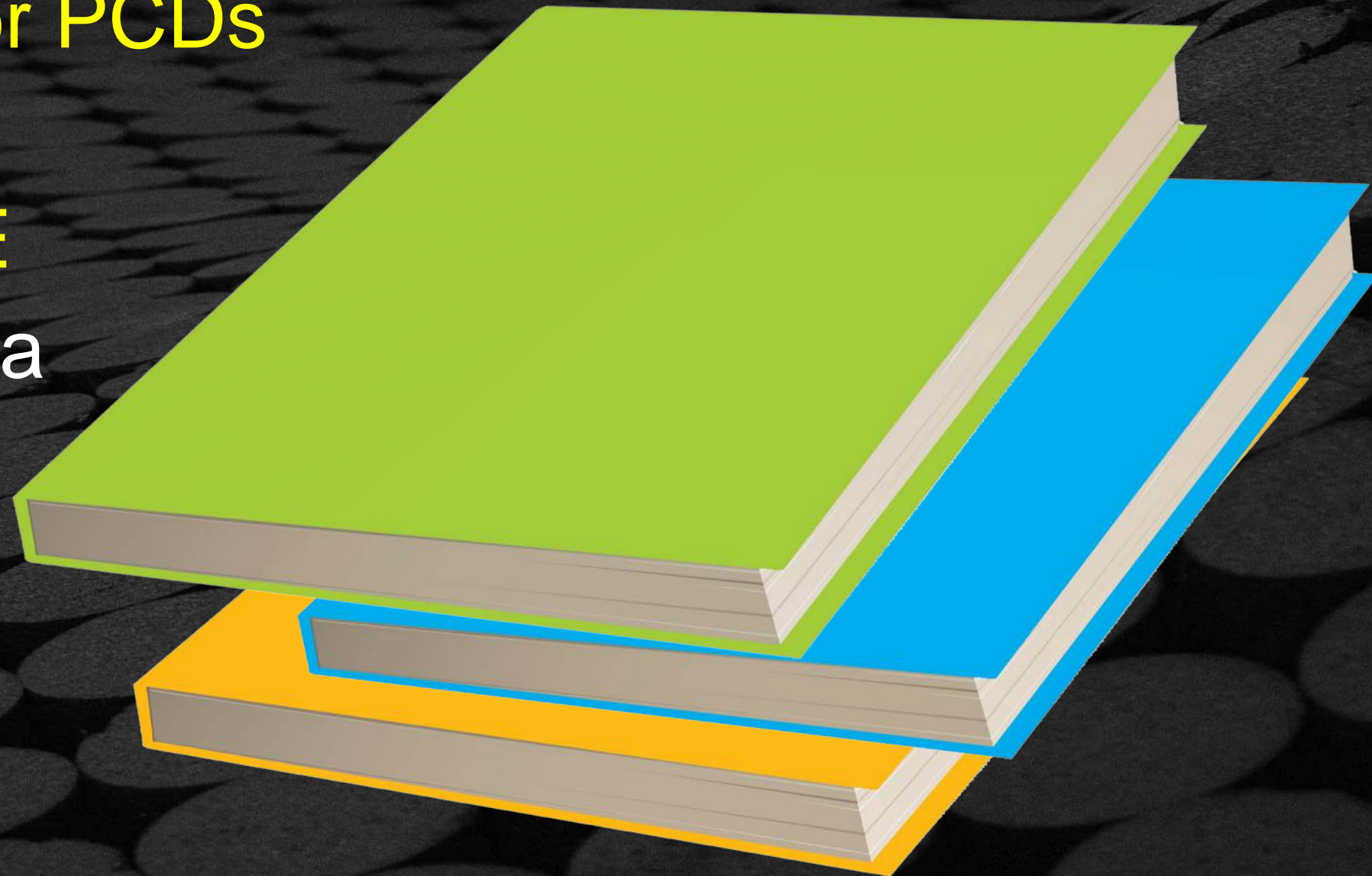
- PCD PEIM produces PCD database
- Two PCD PPIs: PCD\_PPI and EFI\_PEI\_PCD\_PPI

## DXE

- DXE Driver Manages PCDs
- Two PCD Protocols: PCD\_PROTOCOL and EFI\_PCD\_PROTOCOL



- Provides interface for PCDs
- PCD PPI - PEI
- PCD Protocol – DXE
- Allows access to data





# PCD LIBRARY CALLS: PCD PROTOCOL AND PCD PPI FUNCTIONS

```
PcdGetXX()  
PcdSetXX()  
PcdGetExXX()  
PcdSetExXX()  
PcdToken()  
PCDSetSku()  
PcdGetNextToken()  
PcdGetNextTokenSpace()  
CallbackOnSet()  
CancelCallback()
```

Where “XX” =

```
8  
16  
32  
Size  
Ptr  
Boolean
```



PCDs can be located anywhere within the Workspace even though a different package will use those PCDs for a given project

**.DEC**

**Define  
PCD**

**Package**

**.INF**

**Reference  
PCD**

**Module**

**.DSC**

**Modify  
PCD**

**Platform**



# PCD SYNTAX EXAMPLE

DEC

PCD defined in the DEC file from any package

```
[Guids.common]
PcdTokenSpaceGuidName={ 0XXXXXXXXX, 0XXXXX, 0XXXXX, { 0XX, . . .}}

. . .
[Pcds...]
PcdTokenSpaceGuidName.PcdTokenName|Value[|DatumType[|MaxSize]]|Token
```

INF

PCD usage listed in INF file for module

```
[...Pcd...]
PcdTokenSpaceGuidName.PcdTokenName|[Value]
```

DSC

Value of PCD set in Platform DSC

```
[Pcds...]
PcdTokenSpaceGuidName.PcdTokenName|Value[|DatumType[|MaximumDatumSize]]
```



# PCD VARIABLE EXAMPLE

## Defined MdeModulePkg/MdeModulePkg.dec

```
[PcdsFixedAtBuild, PcdsPatchableInModule]
gEfiMdeModulePkgTokenSpaceGuid.PcdMaxVariableSize|0x400|UINT32|0x30000003
```

## Referenced

MdeModulePkg/Universal/Variable/RuntimeDxe/VariableRuntimeDxe.inf

```
[Pcd]
gEfiMdeModulePkgTokenSpaceGuid.PcdMaxVariableSize ## CONSUMES
```

## Modified OvmfPkg/OvmfPkgX64.dsc

```
[PcdsFixedAtBuild]
gEfiMdeModulePkgTokenSpaceGuid.PcdMaxVariableSize|0x008400
```

## Used

MdeModulePkg/Universal/Variable/RuntimeDxe/Variable.c // max NV variable size

```
mVariableModuleGlobal->MaxVariableSize = PcdGet32 (PcdMaxVariableSize);
```



# PCD SOFTWARE

DEC  
+  
INF  
+  
DSC

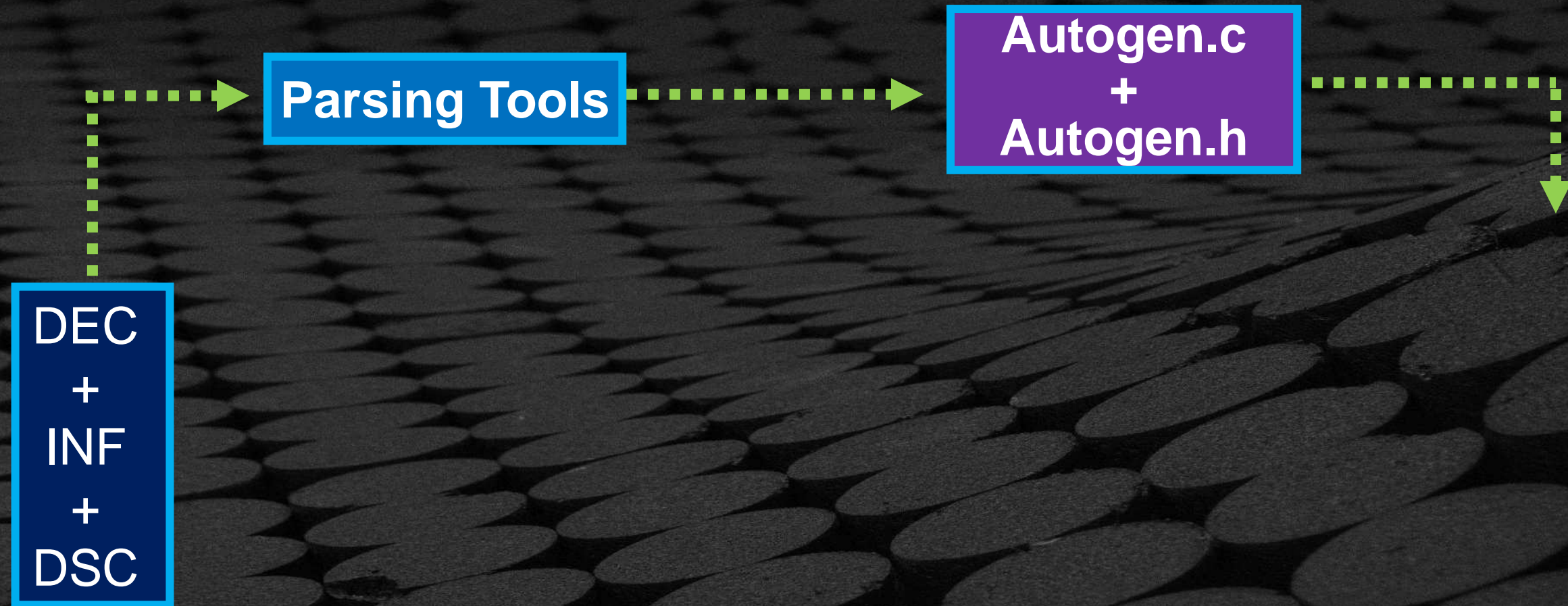


# PCD SOFTWARE



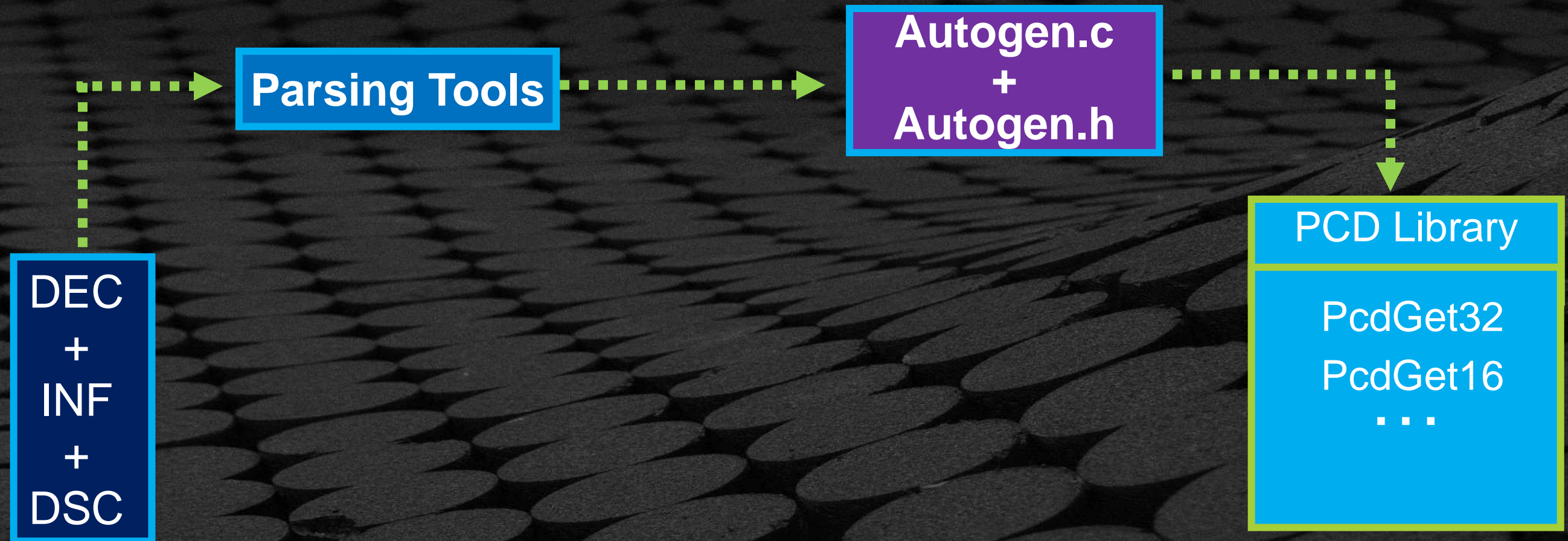


# PCD SOFTWARE



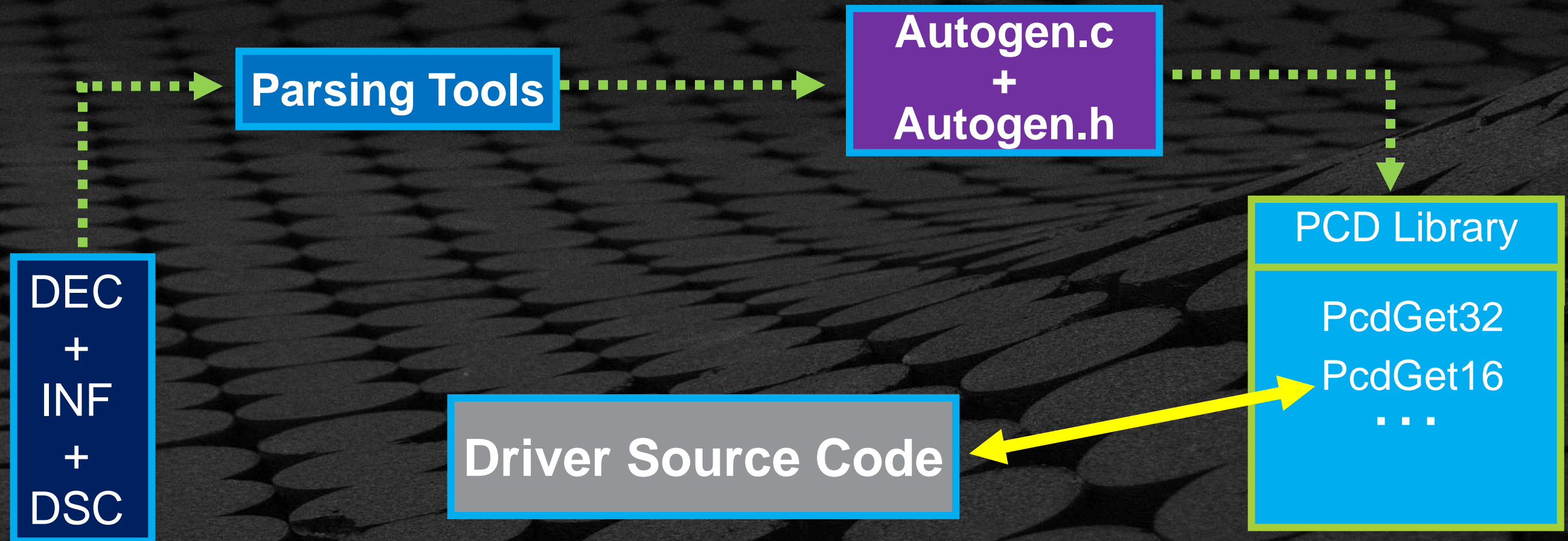


# PCD SOFTWARE





# PCD SOFTWARE



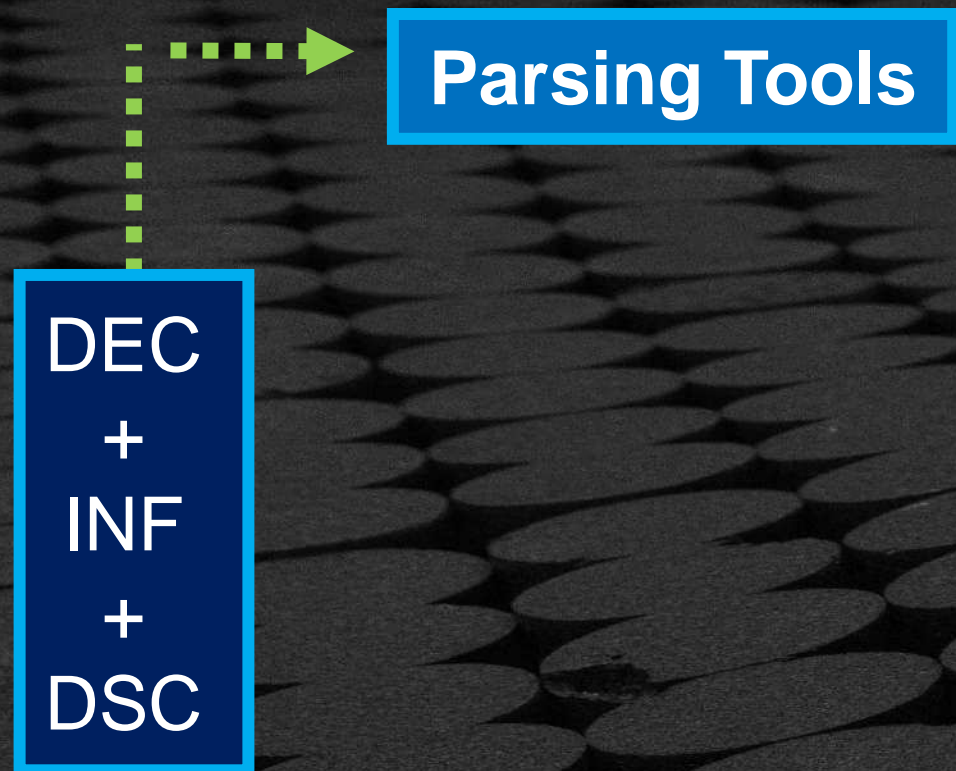


# PCD DRIVER

DEC  
+  
INF  
+  
DSC

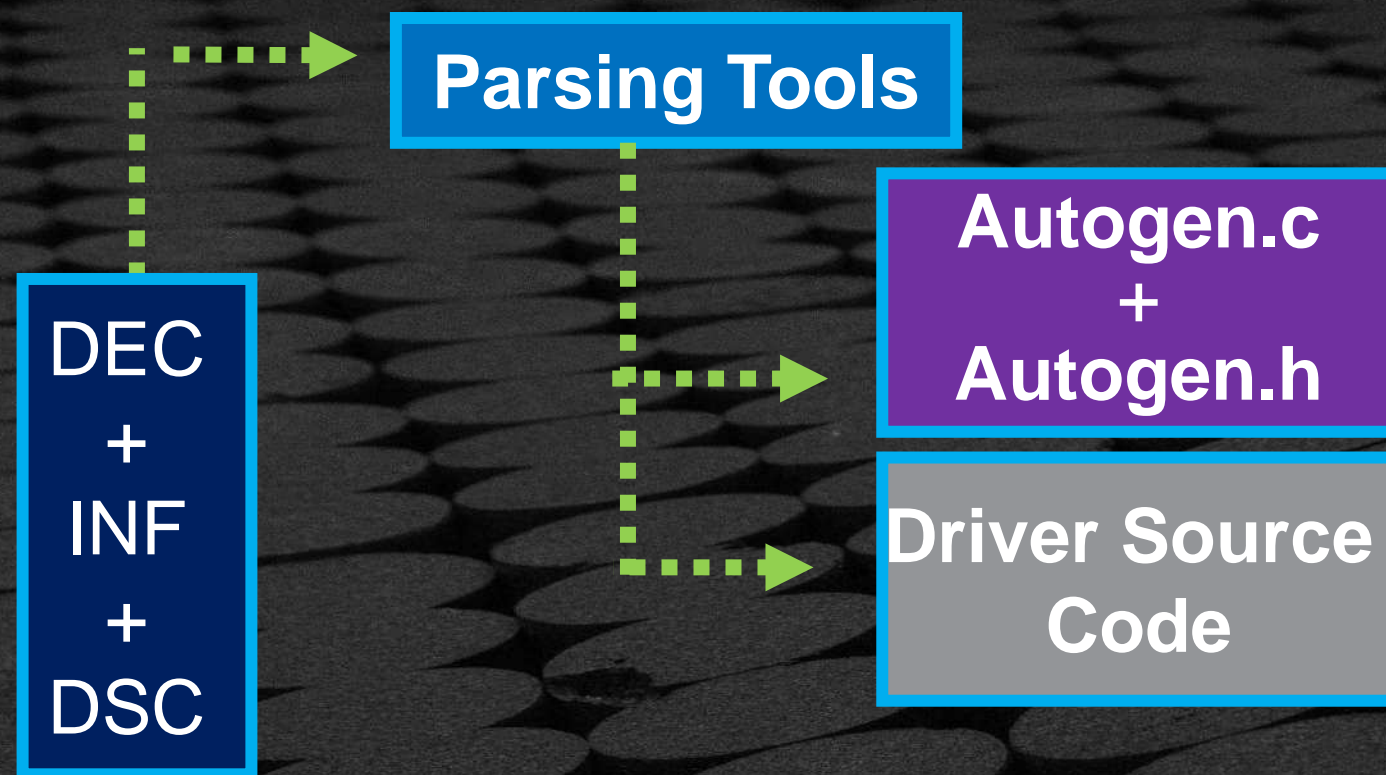


# PCD DRIVER



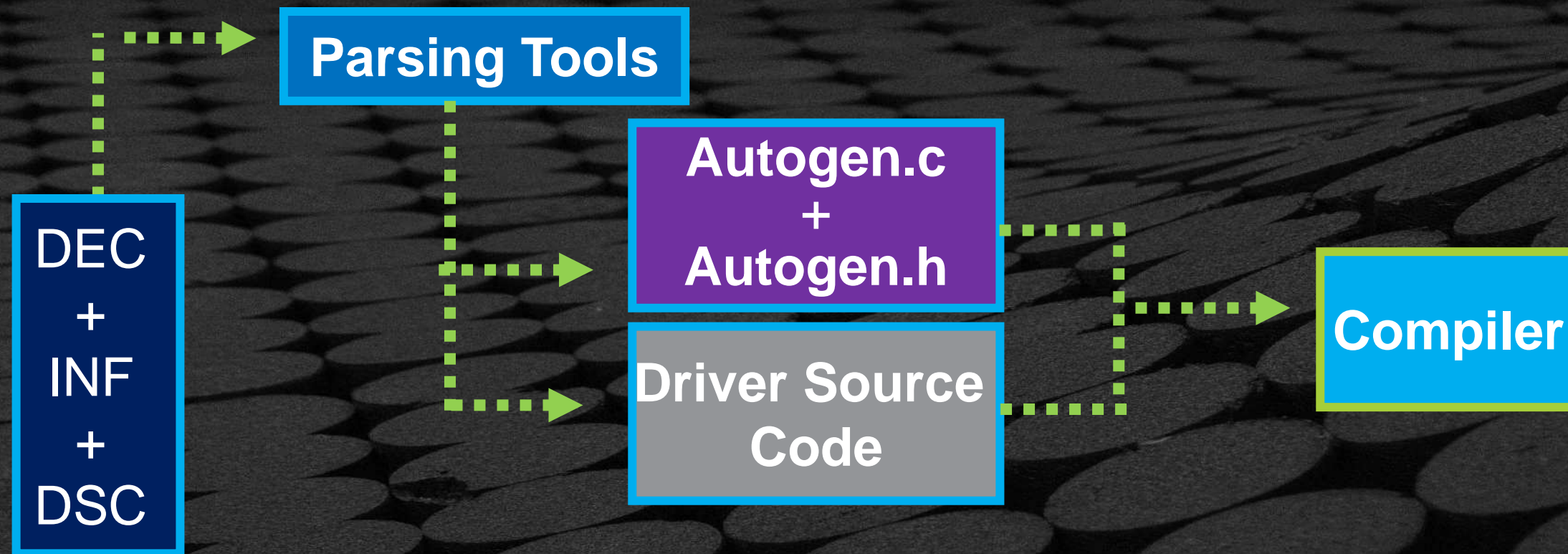


# PCD DRIVER



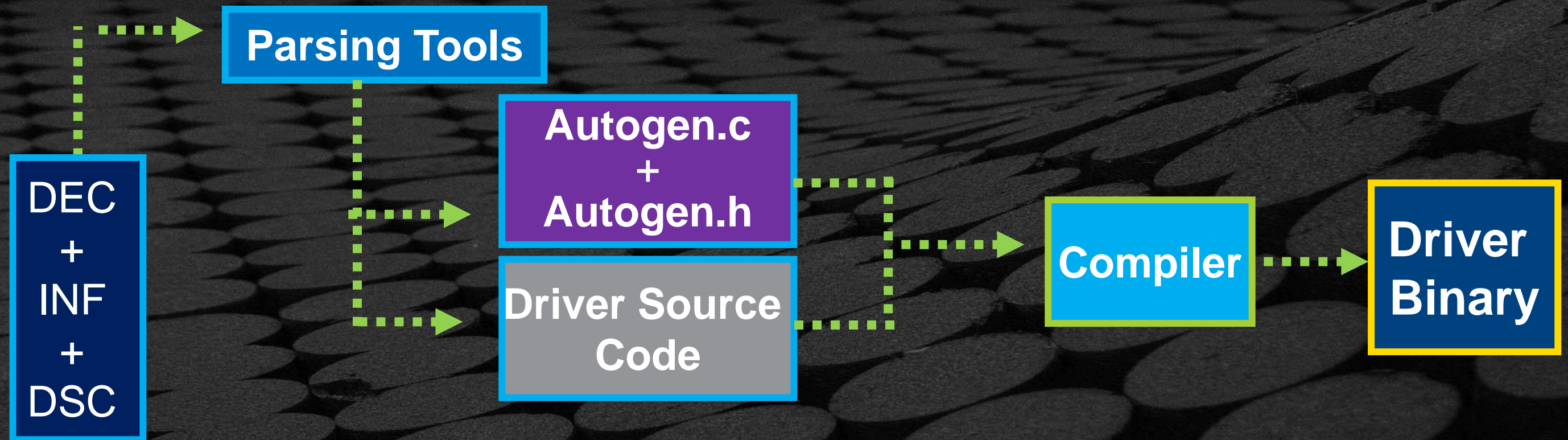


# PCD DRIVER





# PCD DRIVER





# Fixed PCD AutoGen files

Example :  [MdeModulePkg\Universal\Variable\RuntimeDxe\VariableRuntimeDxe](#)

## Autogen.h

```
#define _PCD_TOKEN_PcdMaxVariableSize 250U
#define _PCD_SIZE_PcdMaxVariableSize 4
#define _PCD_GET_MODE_SIZE_PcdMaxVariableSize _PCD_SIZE_PcdMaxVariableSize
#define _PCD_VALUE_PcdMaxVariableSize 0x8400U
extern const UINT32 _gPcd_FixedAtBuild_PcdMaxVariableSize;
#define _PCD_GET_MODE_32_PcdMaxVariableSize _gPcd_FixedAtBuild_PcdMaxVariableSize
```

## Autogen.c

```
// Definition of PCDs used in this module
...
GLOBAL_REMOVE_IF_UNREFERENCED const UINT32 _gPcd_FixedAtBuild_PcdMaxVariableSize =
    _PCD_VALUE_PcdMaxVariableSize;
```



# What about a Dynamic PCDs?

- Only can be Set and changed during Boot time.
- PCD can be set with the library Set: LibPcdSet...
- PCD can be retrieved with the library Get: LibPcdGet...

Example: Use the variable **PcdPlatformBootTimeOut** defined for the platform time in seconds before booting, modified for a value of **03** seconds



## Defined

MdeModulePkg/MdeModulePkg.dec

 DEC

```
[PcdsDynamic]
```

```
gEfiMdePkgTokenSpaceGuid.PcdPlatformBootTimeOut|0xffff|UINT16|0x
```

## Modified

OvmfPkg/OvmfPkg.dsc

 DSC

```
[PcdsDynamicDefault]
```

```
gEfiMdePkgTokenSpaceGuid.PcdPlatformBootTimeOut|03
```

## Setting

OvmfPkg/Library/PlatformBootManagerLib/BdsPlatform.c

 C

```
PcdStatus = PcdSet16S (PcdPlatformBootTimeOut,  
    GetFrontPageTimeoutFromQemu ());
```

## Used

OvmfPkg/Library/QemuBootOrderLib/QemuBootOrderLib.c

 C

```
Timeout = PcdGet16 (PcdPlatformBootTimeOut);
```



# DYNAMIC PCD AUTOGEN FILES

Example Module: (OvmfPkg/Library/PlatformBootManagerLib)

Autogen.h

• • •

```
#define _PCD_SET_MODE_16_PcdPlatformBootTimeOut(Value) \
    LibPcdSet16(_PCD_TOKEN_PcdPlatformBootTimeOut, ( Value ))
#define _PCD_SET_MODE_16_S_PcdPlatformBootTimeOut(Value) \
    LibPcdSet16S(_PCD_TOKEN_PcdPlatformBootTimeOut, ( Value ))
```

Example Module: (MdeModulePkg/Universal/PCD/Dxe/Pcd)

Autogen.c

```
DXE_PCD_DATABASE_INIT gDXEPcdDbInit = {
    • • •
    /* LocalTokenNumberTable */
    • • •
    offsetof(DXE_PCD_DATABASE, Init.PcdPlatformBootTimeOut_*1) | PCD_TYPE_DATA | PCD_DATUM_TYPE_UINT16,
    • • •
    { 0x3U } /* PcdPlatformBootTimeOut_*1 [1] */,
```

\*1 GUID of PCD Variable PcdPlatformBootTimeOut



## Multi-Structure PCD

- C data structure and assign the value to each sub-field directly

## Multi-Sku PCD

- Multiple configurations generated at build time & set @ run time, (PI Spec Vol 3 chap. 8)

## DefaultStores PCD

- Support the default stores concept in UEFI specification, (UEFI, HII Chap. 32)



# Multiple “C” Data Structure as PCDs

Example: `edk2-platforms/ Platform/ Intel/ AdvancedFeaturePkg.dec/`

## SMBIOS type 0 data structure

```
gAdvancedFeaturePkgTokenSpaceGuid.PcdSmbiosType0BiosInformation| \  
    {0x0}|SMBIOS_TABLE_TYPE0|0x80010000 {  
    <HeaderFiles>  
        IndustryStandard/SmBios.h  
    <Packages>  
        MdePkg/MdePkg.dec  
        AdvancedFeaturePkg/AdvancedFeaturePkg.dec  
}  
gAdvancedFeaturePkgTokenSpaceGuid.PcdSmbiosType0BiosInformation.Vendor|0x1  
gAdvancedFeaturePkgTokenSpaceGuid.PcdSmbiosType0BiosInformation.BiosVersion|0x2  
gAdvancedFeaturePkgTokenSpaceGuid.PcdSmbiosType0BiosInformation.BiosSegment|0xF000  
gAdvancedFeaturePkgTokenSpaceGuid.PcdSmbiosType0BiosInformation.BiosReleaseDate|0x3  
gAdvancedFeaturePkgTokenSpaceGuid.PcdSmbiosType0BiosInformation.BiosSize|0xFF  
gAdvancedFeaturePkgTokenSpaceGuid.PcdSmbiosType0BiosInformation.BiosCharacteristics.\  
    PciIsSupported|1  
gAdvancedFeaturePkgTokenSpaceGuid.PcdSmbiosType0BiosInformation.BiosCharacteristics.\  
    PlugAndPlayIsSupported|1
```



## DSC File – SKU Set at BUILD time

```
• • •
SKUID_IDENTIFIER = ?

[SkuIds]
0|DEFAULT
4|BoardX
0x42|BoardY

[PcdsDynamicDefault.common.BoardX]
gBoardModuleTokenSpaceGuid.PcdGpioPin|0x8
gBoardModuleTokenSpaceGuid.PcdGpioInitValue|\
    {0x00, 0x04, 0x02, 0x04, ...}

[PcdsDynamicDefault.common.BoardY]
gBoardModuleTokenSpaceGuid.PcdGpioPin|0x4
gBoardModuleTokenSpaceGuid.PcdGpioInitValue|\
    {0x00, 0x02, 0x01, 0x02, ...}
```

## SKU PCD Set Dynamically

```
BoardXBoardDetect( VOID)
{
    • • •
    if (LibPcdGetSku () != 0) {
        return EFI_SUCCESS;
    }
    if (IsBoardX ()) {
        LibPcdSetSku (BoardIdIsBoardX);
        ASSERT (LibPcdGetSku() ==
                BoardIdIsBoardX);
    }
    return EFI_SUCCESS;
}
```



## DSC File –

• • •  
VPD\_TOOL\_GUID = 8C3D856A-9 ...

```
[DefaultStores]
0|STANDARD
1|MANUFACTURING
2|SAFE
```

```
[PcdsDynamicExVpd.common.DEFAULT]
  gEfiMdeModulePkgTokenSpaceGuid.PcdNvStoreDefaultValueBuffer|*
[PcdsDynamicEx.common.DEFAULT.STANDARD]
  gOemSkuTokenSpaceGuid.PcdSetupData.CloudProfile|0x0
  gOemSkuTokenSpaceGuid.PcdSetupData.Use1GPageTable|0x1
[PcdsDynamicEx.common.DEFAULT.MANUFACTURING]
  gOemSkuTokenSpaceGuid.PcdSetupData.CloudProfile|0x1
  gOemSkuTokenSpaceGuid.PcdSetupData.Use1GPageTable|0x0
```

- Special PCD to support the default stores concept in UEFI specification
- Can be Dynamically set



# SUMMARY

- ★ Define Platform Configuration Database (PCD) and explain the syntax
- ★ Differentiate types of PCDs
- ★ Explain how changing a PCD value affects output
- ★ Evaluate the results of a PCD value modification
- ★ Special PCDs



# Questions?





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# BACKUP



# PCD Dynamic and DynamicEx

## PCD DynamicEx (follows PI 1.x Spec)

- Referenced using Token Number and GUID
- Required for modules that are distributed as binaries
- The size is slightly larger compare with Dynamic

## PCD Dynamic

- Referenced only by a Token Number without a GUID
- Useful for modules that are build from sources
- Reduce the size overhead of using PCDs

**Dynamic PCD is size optimized compared to DynamicEX when modules are build from source**