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UEFI & EDK II Training

How to Write a UEFI Driver

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LESSON OBJECTIVE

- What is the UEFI Driver Model
- Details on Driver Binding Protocol
- Example of UEFI Driver

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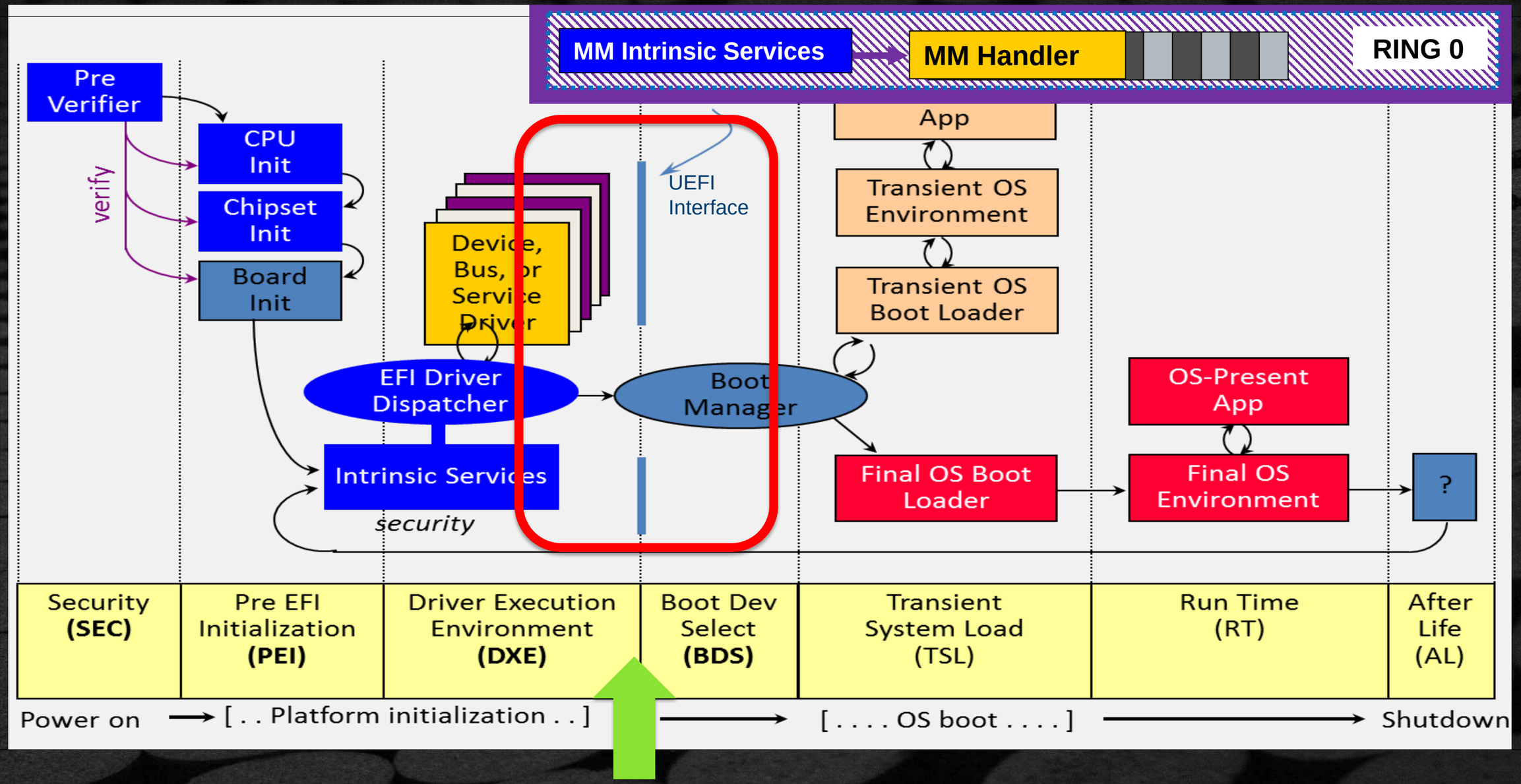
UEFI DRIVER MODEL

UEFI Drivers - Location



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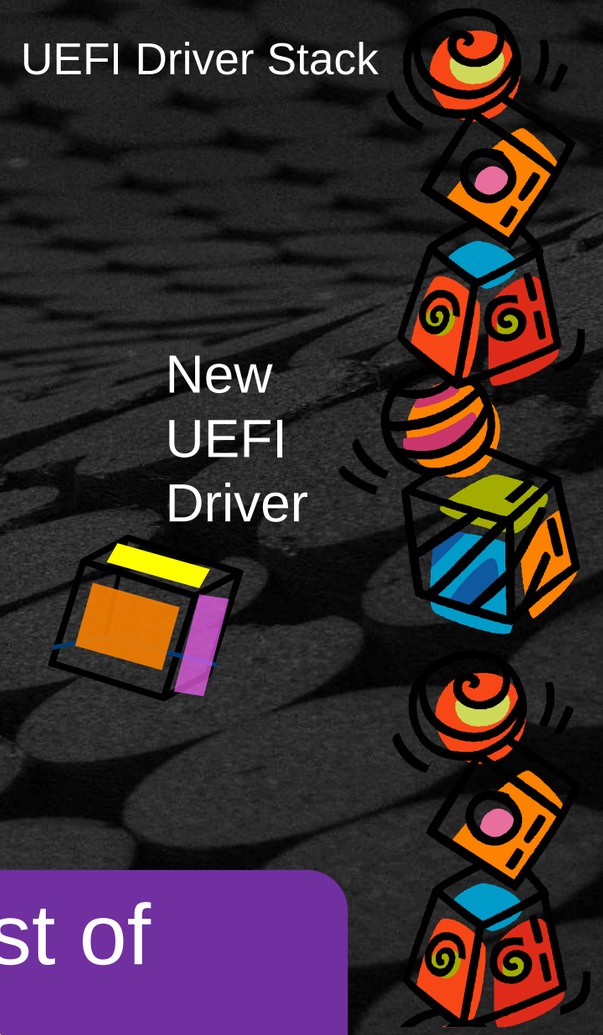
What are UEFI Drivers ?

- UEFI Drivers extend firmware
- Portable across platforms
- Enables rapid development
- Produce Protocols



UEFI driver is chained into a link list of
Drivers Managing Devices

Defining a UEFI Driver

UEFI Loadable Image

May produce/consume protocols

Supports complex bus hierarchies

Driver Binding Protocol matches drivers to devices, adds version management

Supports specific hardware, can be unloaded or override an existing driver

What is a UEFI protocol?

Protocols

- Interfaces consisting of functions and data structures named by a GUID and stored in the Handle Database

Handle Database

- Everything in the platform system gets a handle, drivers, devices, Images, etc.

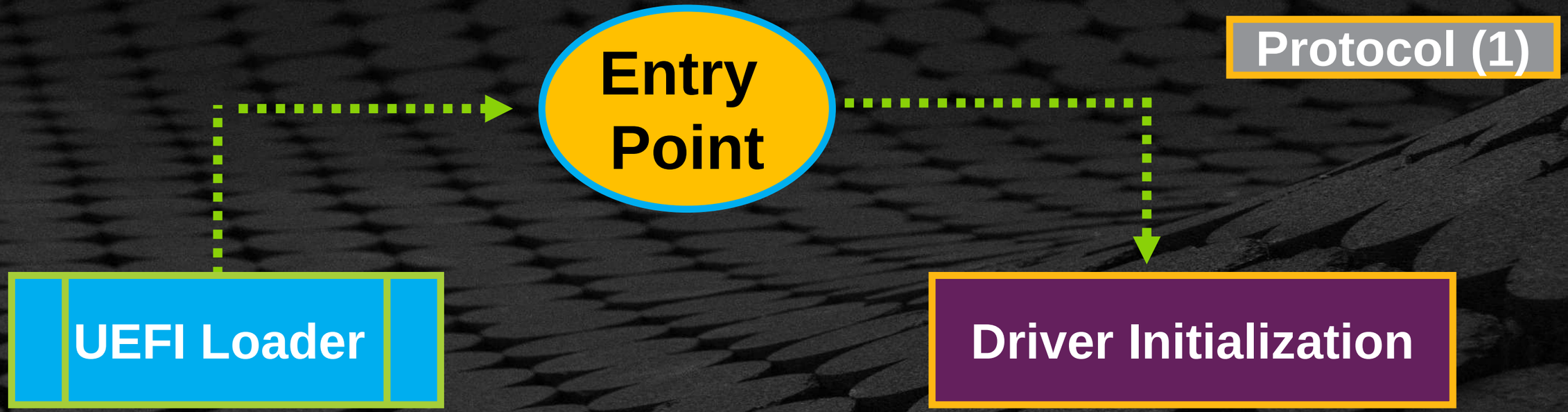
GUIDs

- The UEFI Platform only knows items in the Handle Database by its GUID

UEFI Drivers Vs. Applications

UEFI Drivers Vs. Applications

UEFI Drivers Vs. Applications



UEFI Drivers Vs. Applications

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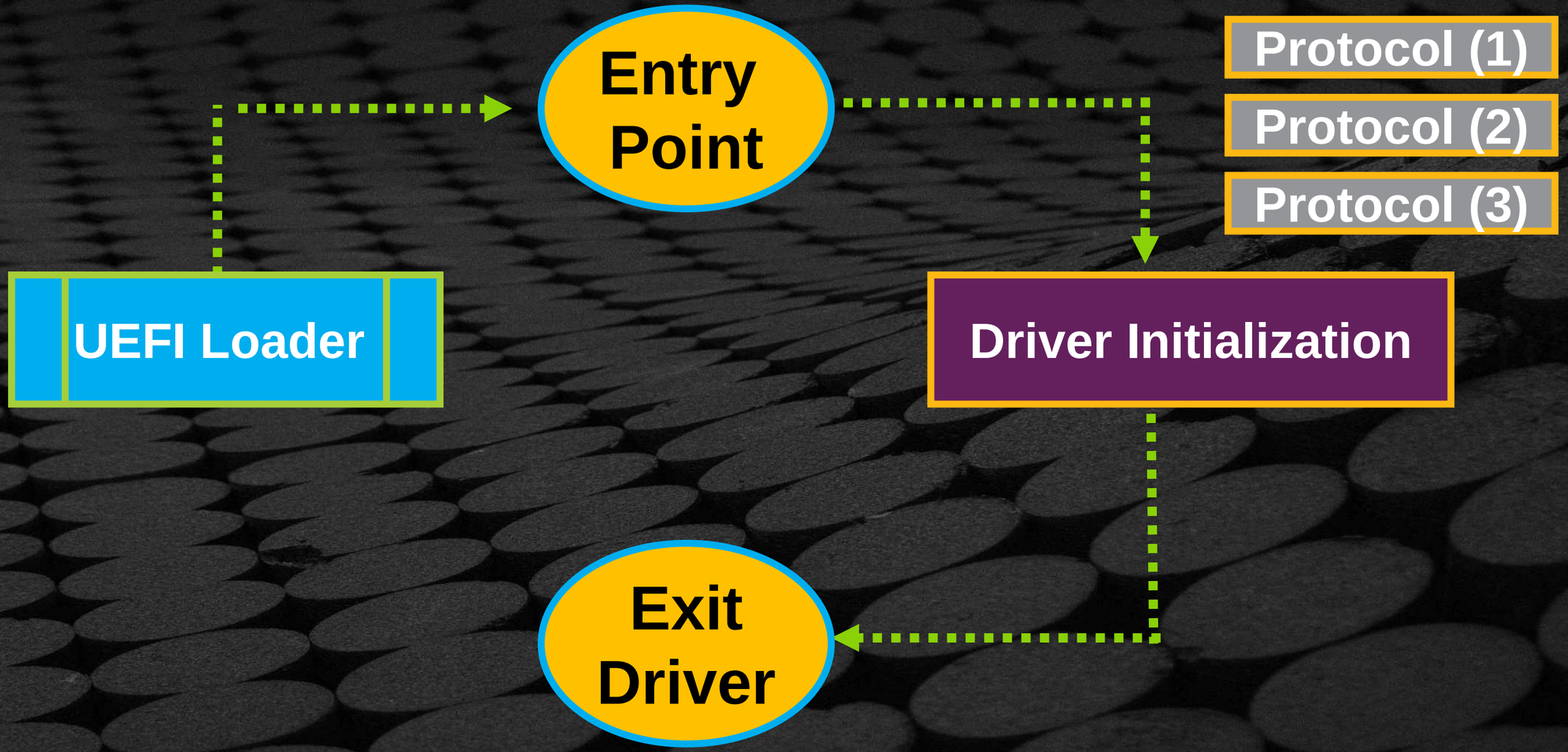
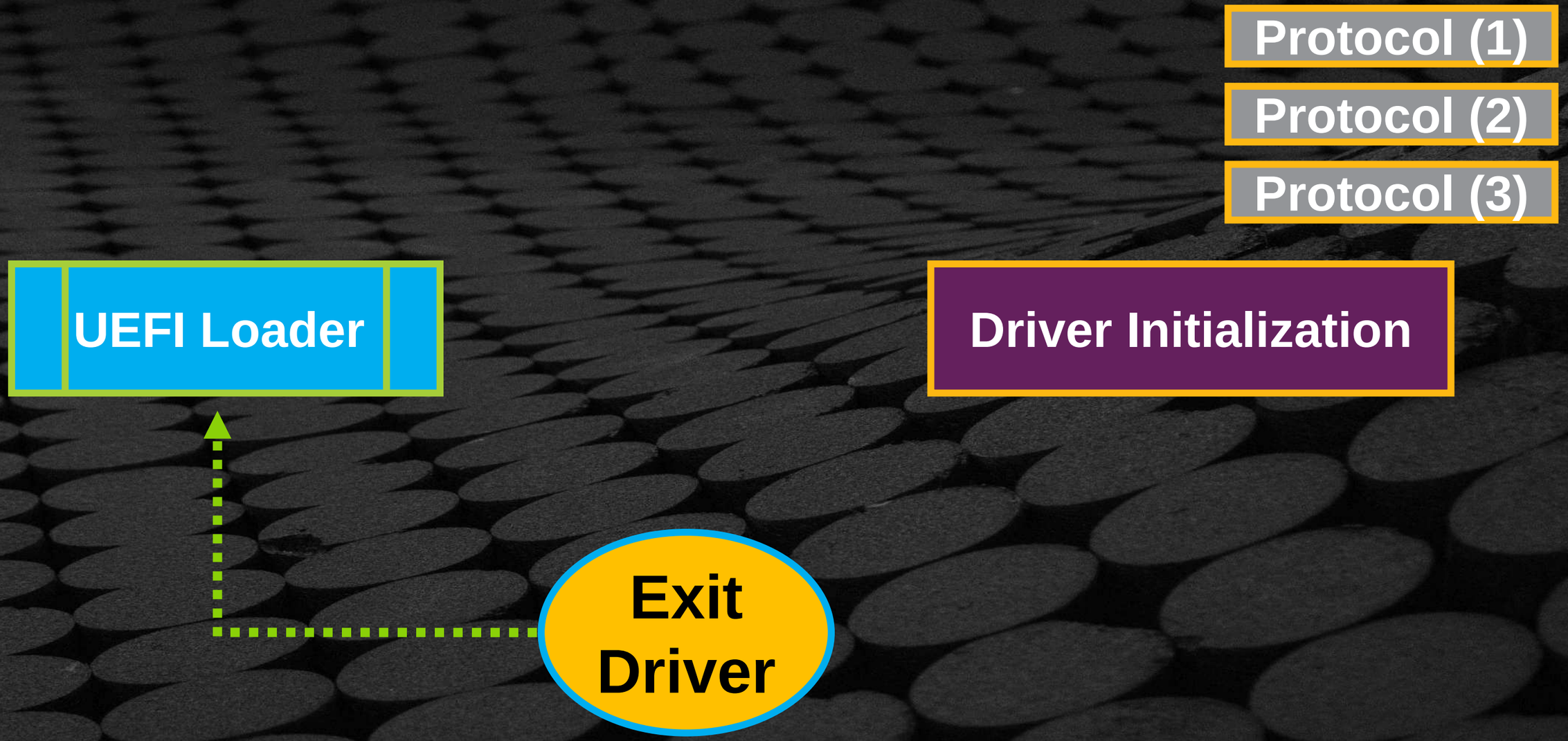
UEFI Drivers Vs. Applications



UEFI Drivers Vs. Applications



UEFI Drivers Vs. Applications

Protocol (1)

Protocol (2)

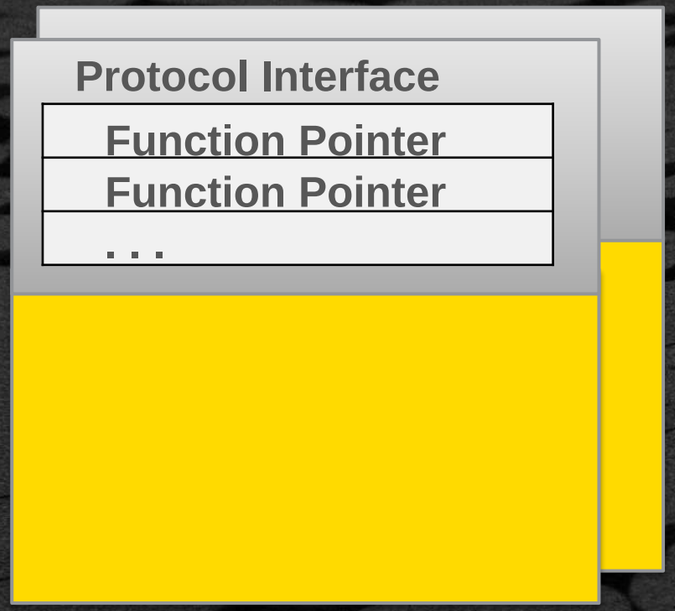
Protocol (3)

UEFI Loader

Driver Initialization

UEFI Drivers Vs. Applications

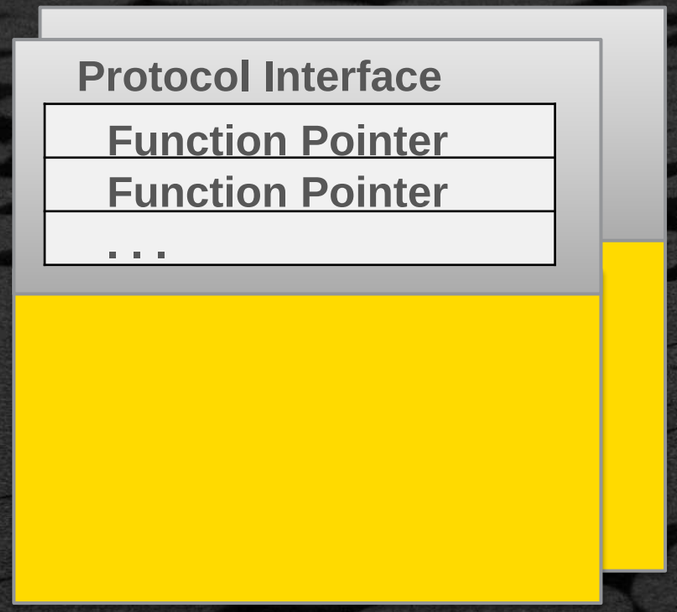
Drivers Produce Protocols



Handle Database

Drivers Produce Protocols

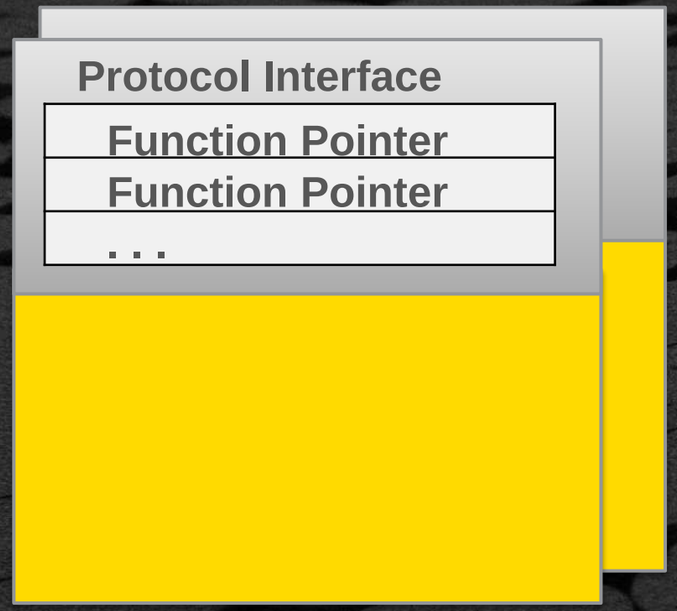
Construction of a protocol



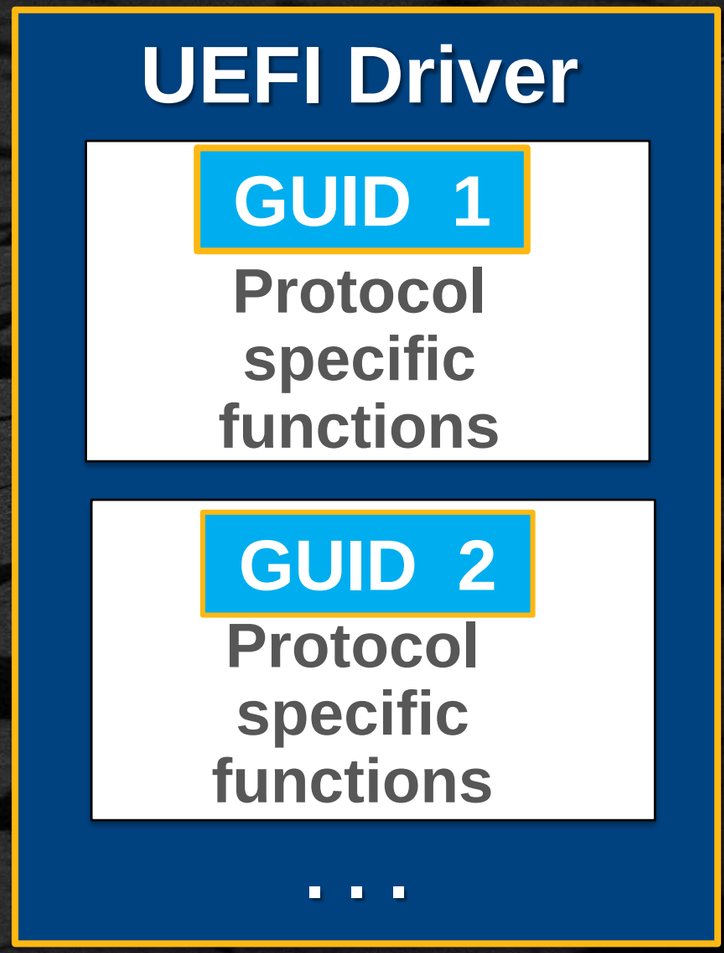
Handle Database

Drivers Produce Protocols

Construction of a protocol



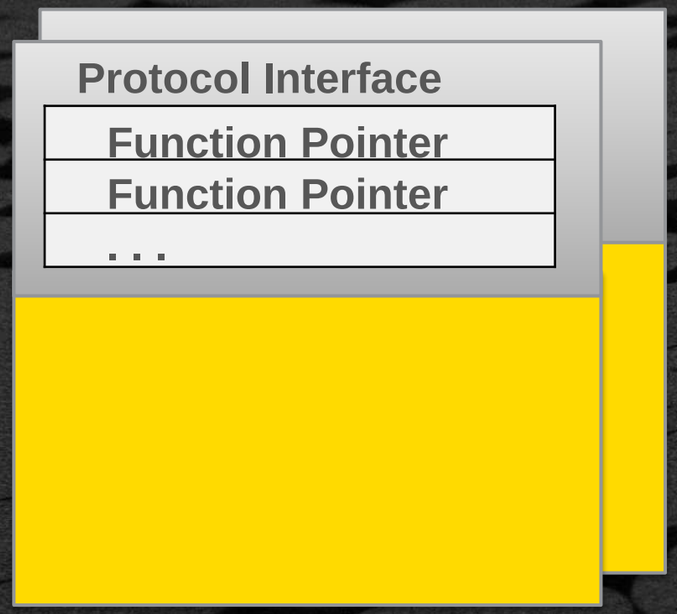
Handle Database



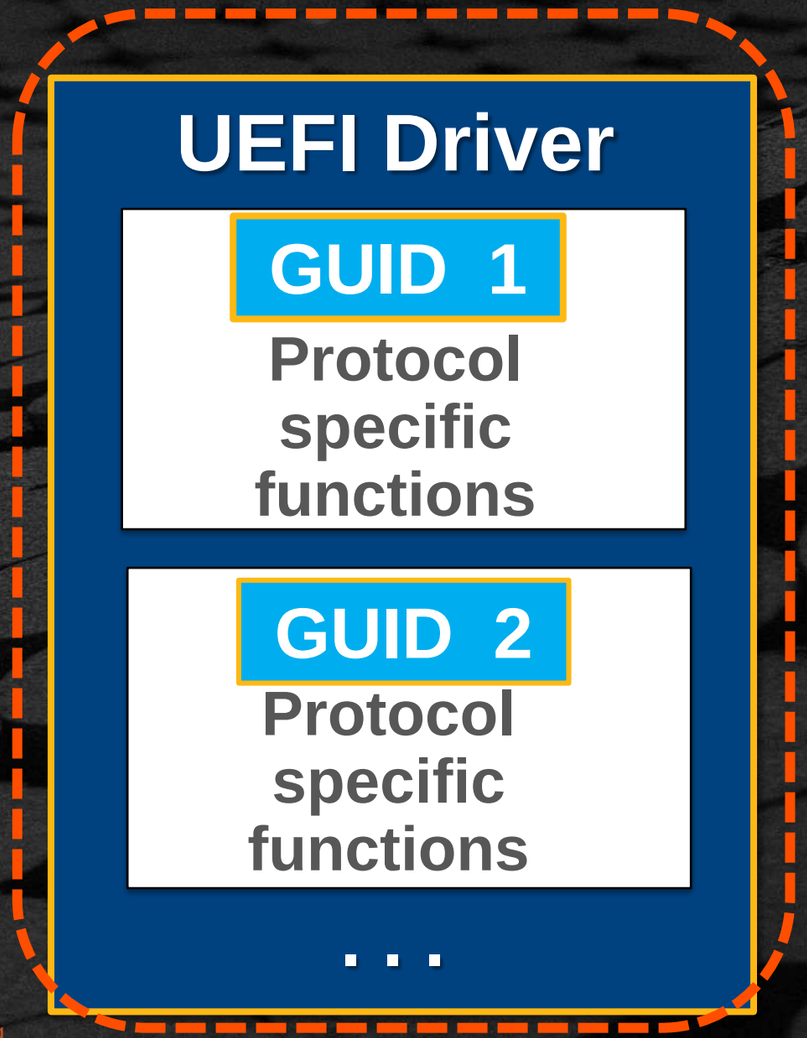
Drivers Produce Protocols

Construction of a protocol

`InstallProtocolInterface`



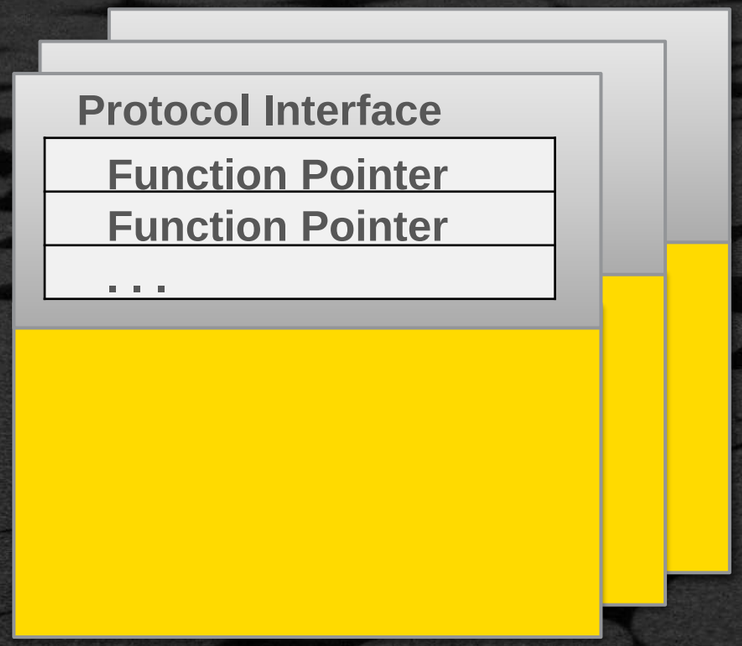
Handle Database



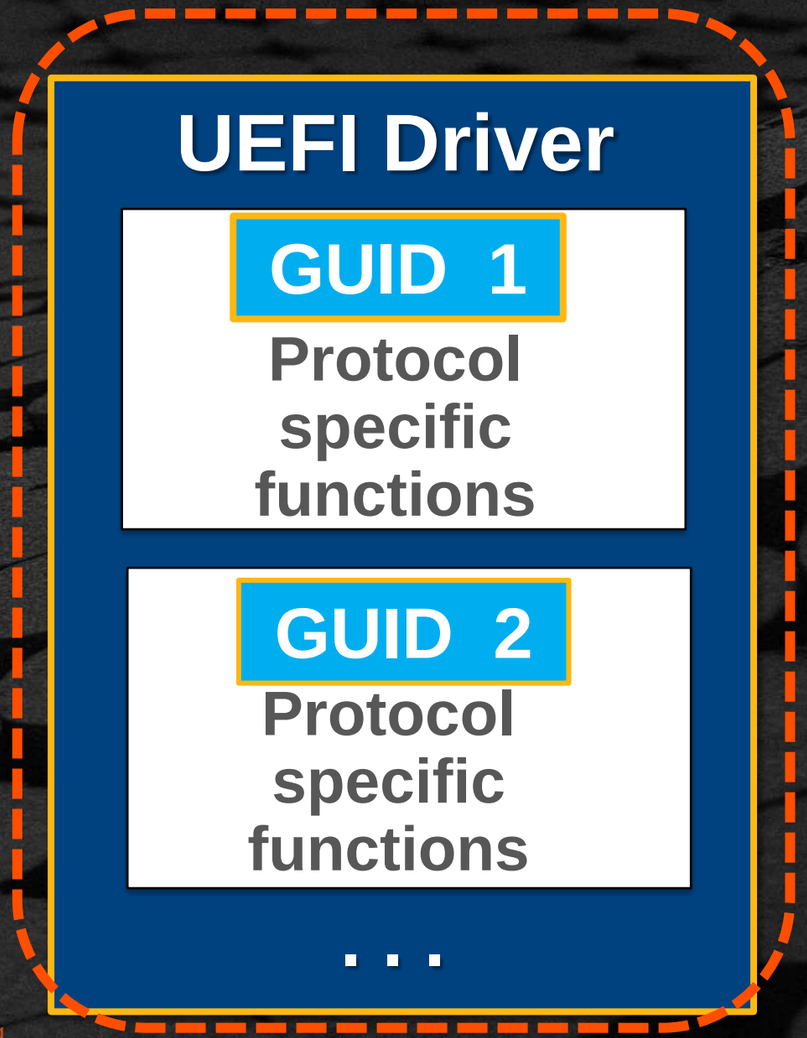
Drivers Produce Protocols

Construction of a protocol

`InstallProtocolInterface`



Handle Database

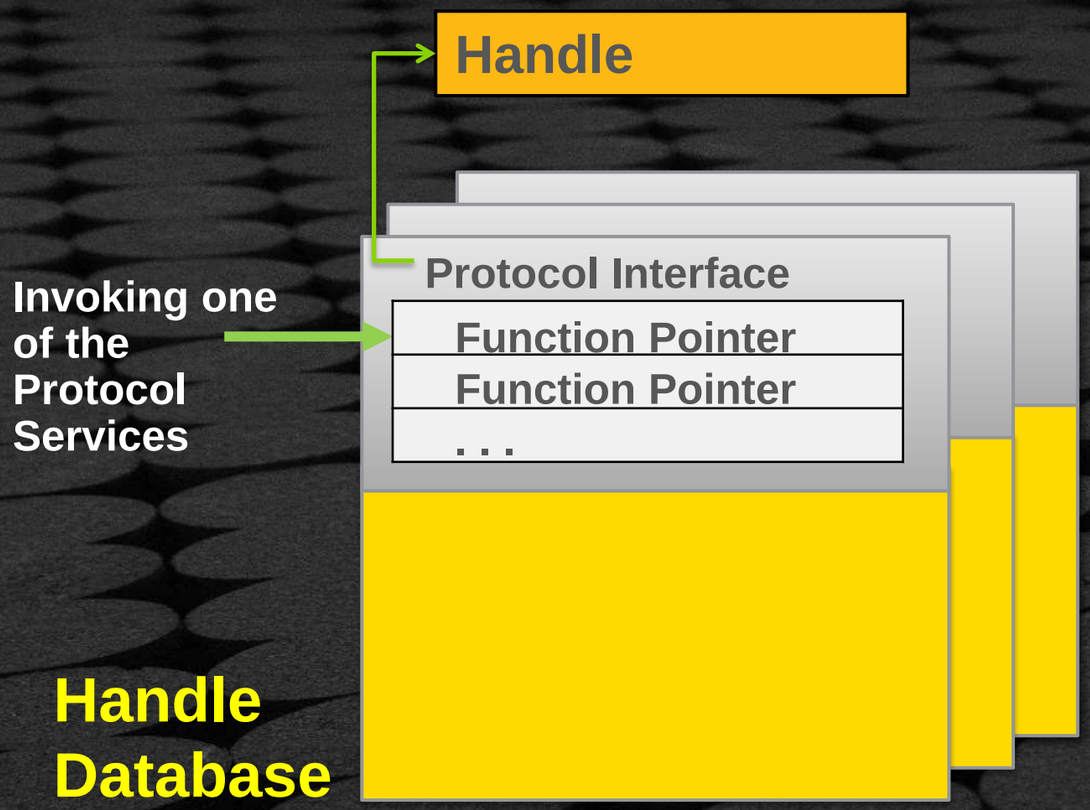


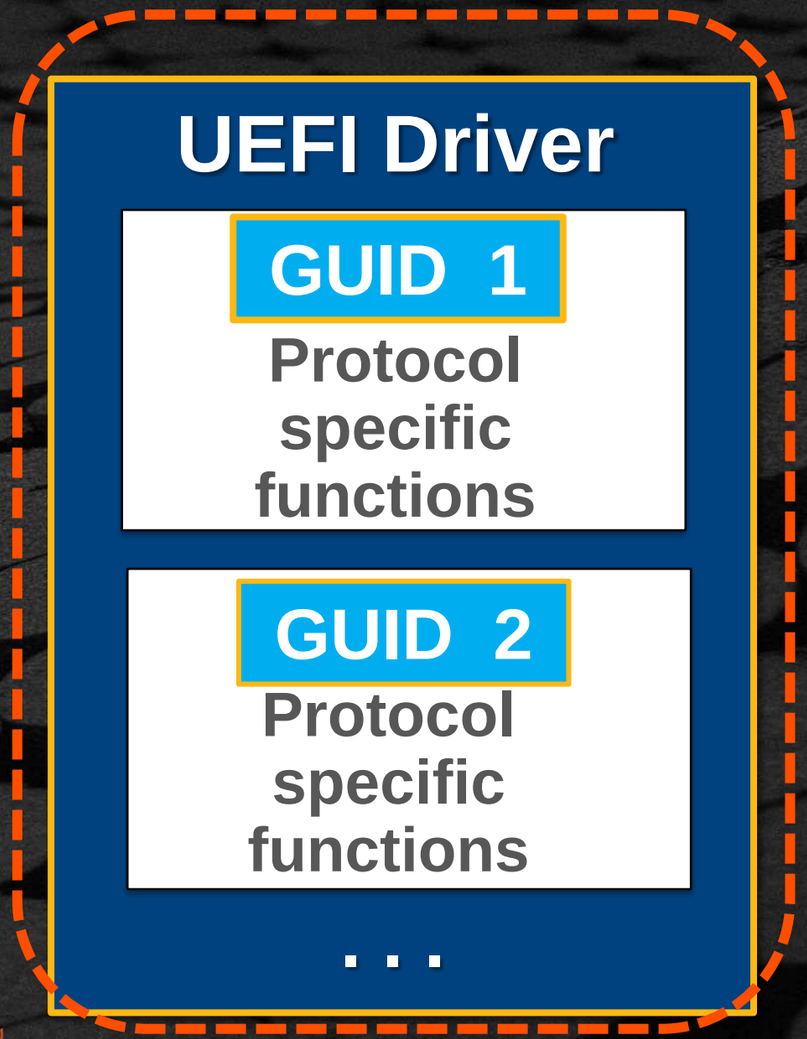
Drivers Produce Protocols

Construction of a protocol

`InstallProtocolInterface`

HandleProtocol(GUID, …)

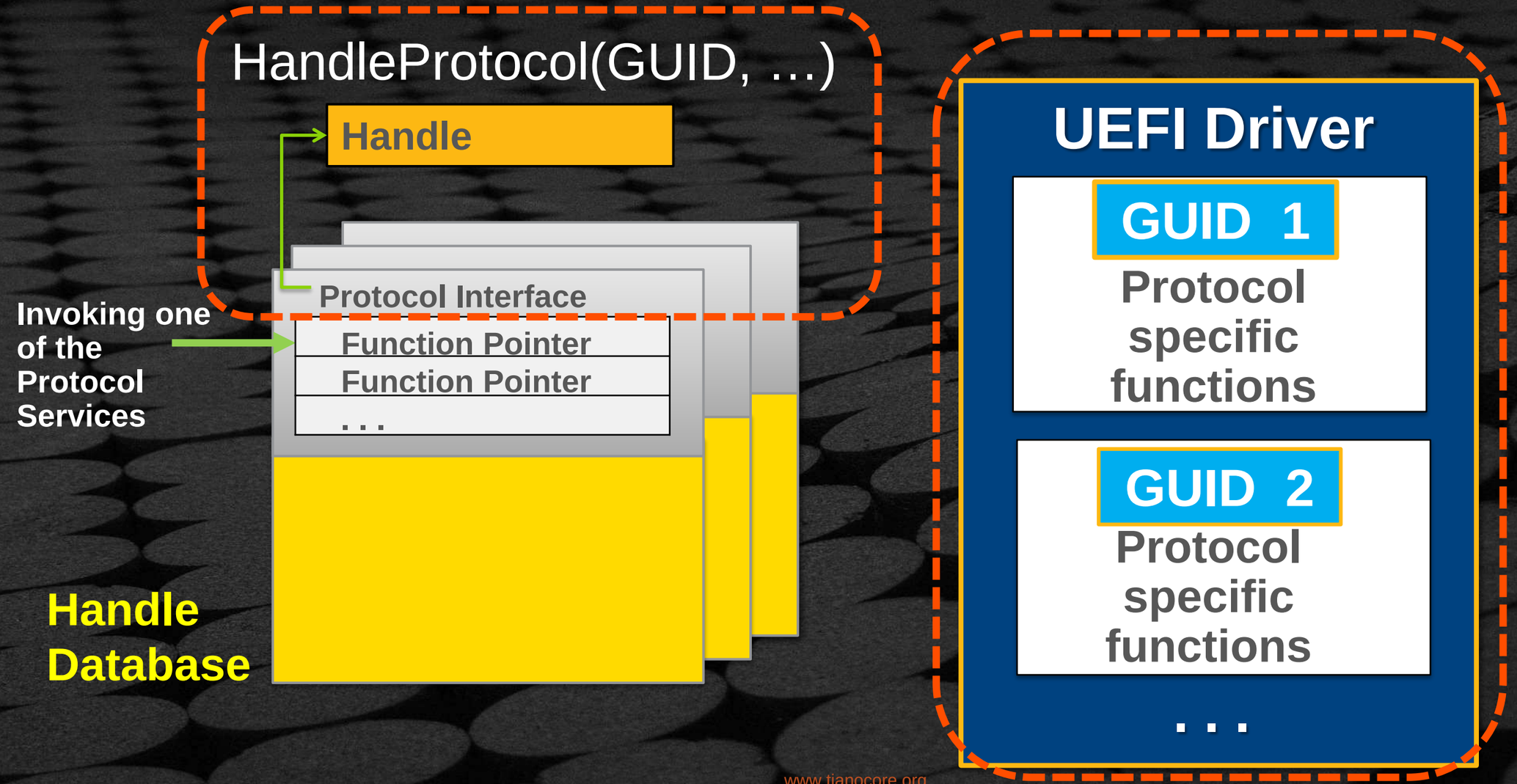




Drivers Produce Protocols

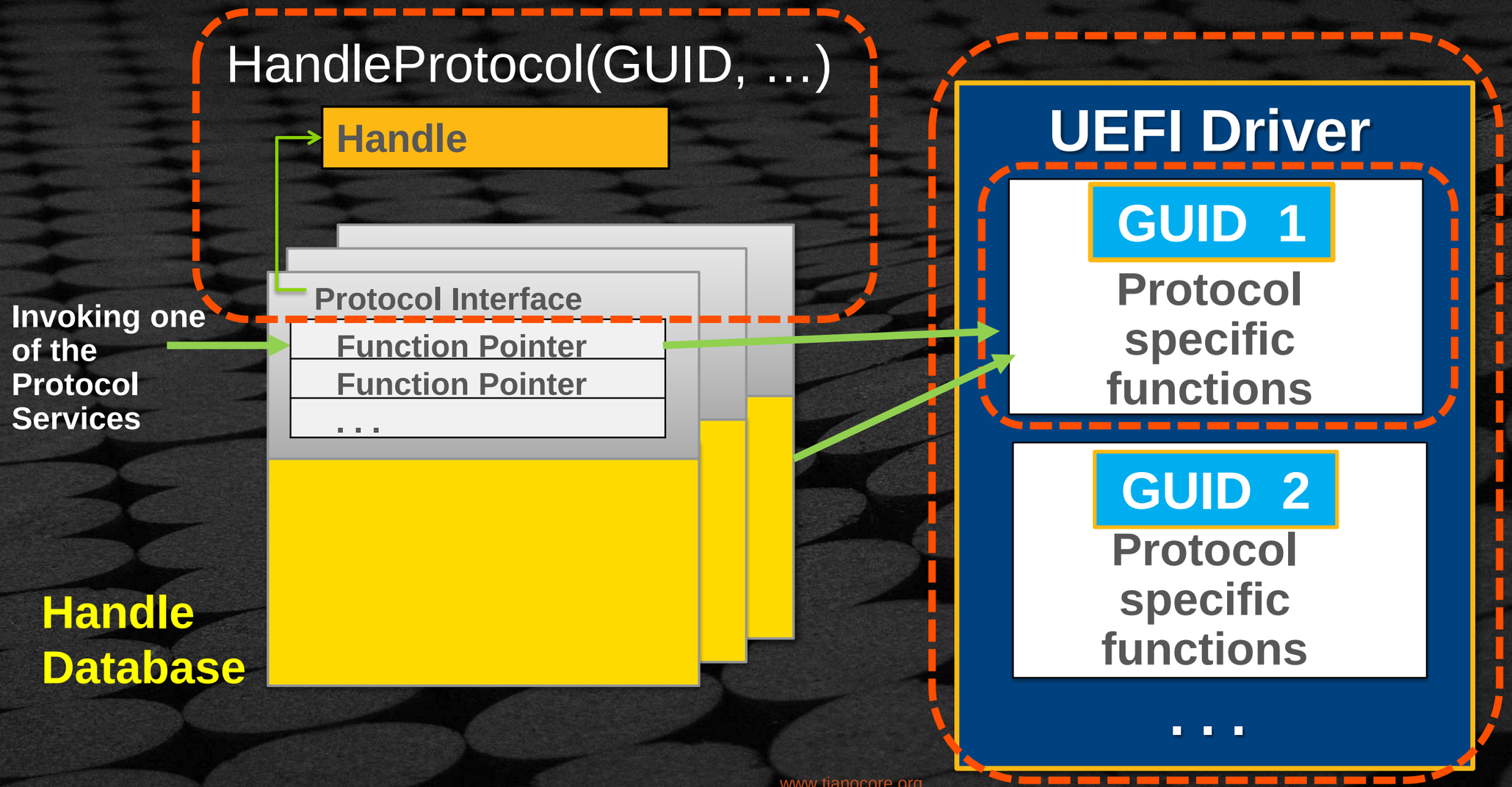
Construction of a protocol

`InstallProtocolInterface`



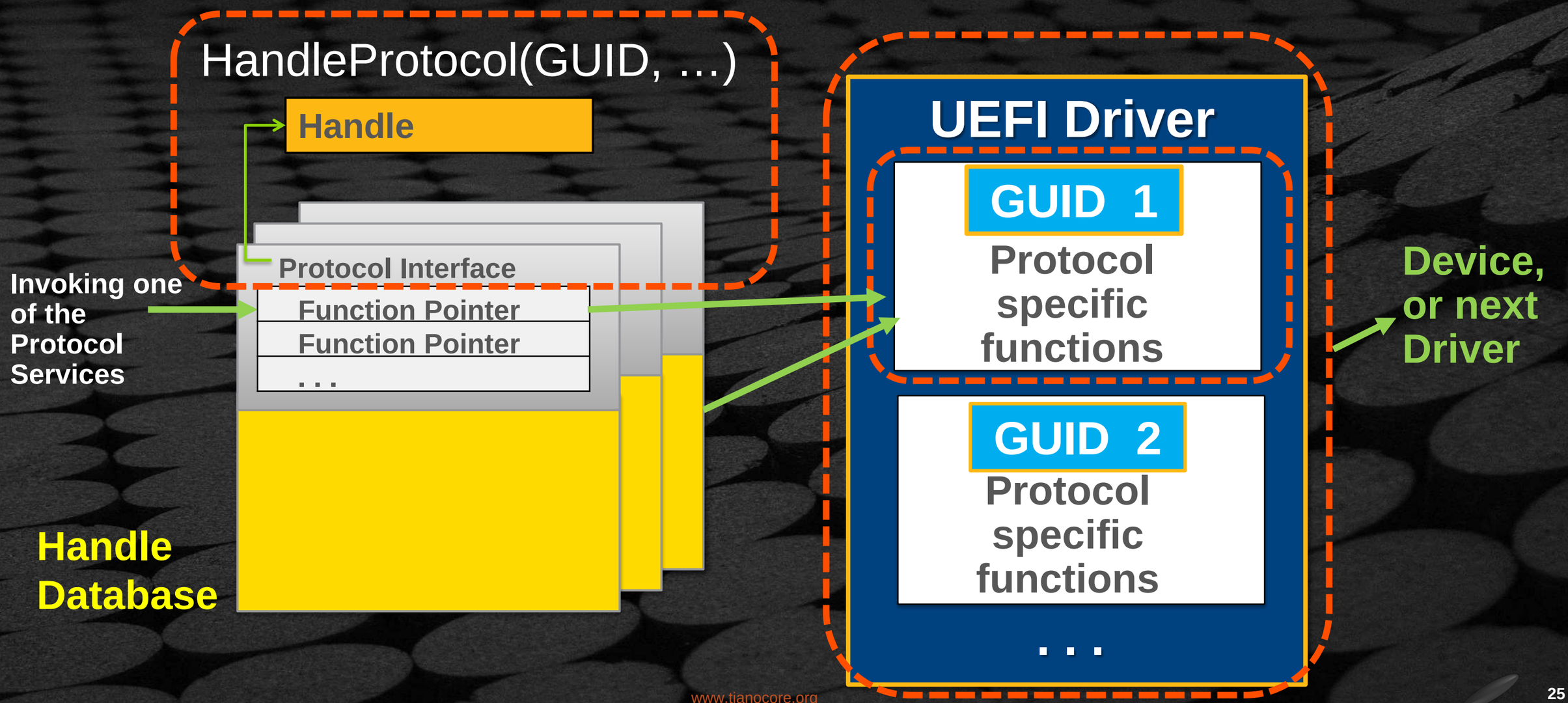
Drivers Produce Protocols

Construction of a protocol



Drivers Produce Protocols

Construction of a protocol



UEFI Driver Binding Protocol

`Supported()`

Determines if a driver supports a controller

`Start()`

Starts a driver on a controller & Installs Protocols

`Stop()`

Stops a driver from managing a controller

Supported - PCI Controller Device Handle

PCI Controller Device Handle
EFI_DEVICE_PATH_PROTOCOL
EFI_PCI_IO_PROTOCOL

Tasks

1. ***Opens*** PCI_IO Protocol
2. Checks
3. ***Closes*** PCI_IO Protocol
4. Returns: *Supported* or *Not Supported*

See § 10.1 UEFI 2.x Spec.

Inputs:

- "This"
- Controller to manage
- Remaining Device Path

Supported()

- Checks to see if a driver supports a controller
- Check should not change hardware state of controller
- Minimize execution time, move complex I/O to Start()
- May be called for controller that is already managed
- Child is optionally specified

Start - PCI Controller Device Handle

PCI Controller Device Handle
EFI_DEVICE_PATH_PROTOCOL
EFI_PCI_IO_PROTOCOL
EFI_BLOCK_IO_PROTOCOL

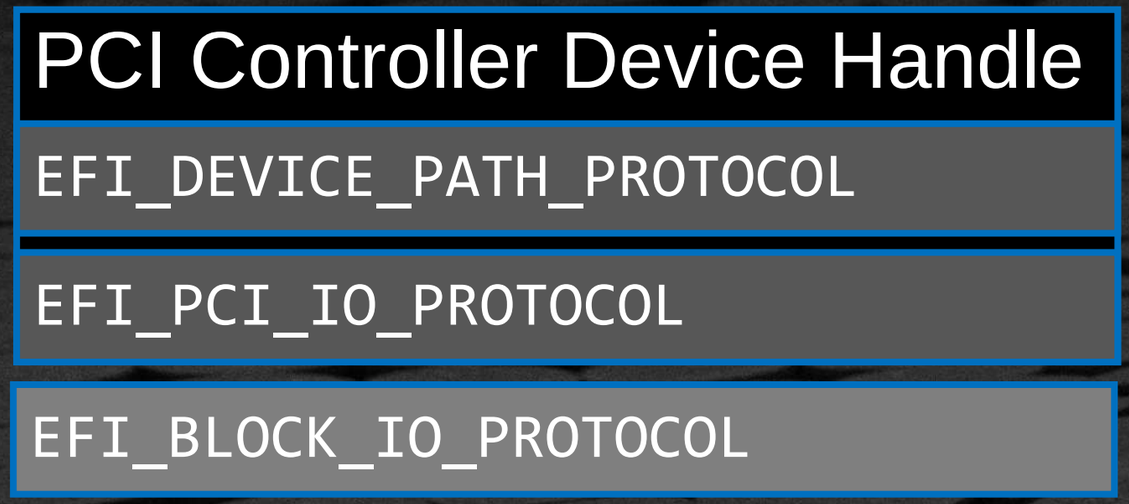
Inputs:

- “This”
- Controller to manage,
- Remaining Device Path

Start()

- ***Opens*** PCI I/O
- Starts a driver on a controller
- Can create ALL child handles or ONE child handle

Stop - PCI Controller Device Handle



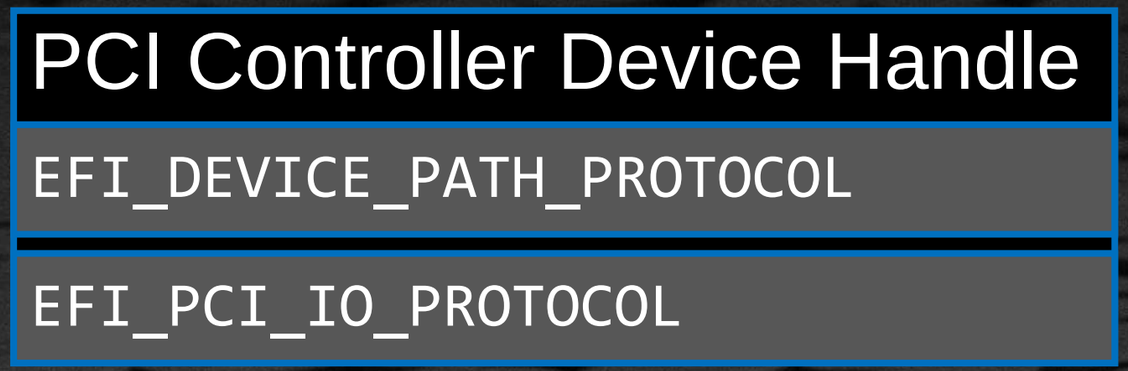
Inputs:

- “This”
- Controller to manage,
- Remaining Device Path

Stop()

- ***Closes*** PCI I/O
- Stops a driver from managing a controller
- Destroys all specified child handles
- If no children specified, controller is stopped
- Stopping a bus controller requires 2 calls
  - One call to stop the children. A second call to stop the bus controller itself

Stop - PCI Controller Device Handle



Inputs:

- “This”
- Controller to manage,
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Stop()

- ***Closes*** PCI I/O
- Stops a driver from managing a controller
- Destroys all specified child handles
- If no children specified, controller is stopped
- Stopping a bus controller requires 2 calls
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UEFI DRIVER EXAMPLE

Examine details of the UEFI Driver - ScsiDiskDxe

Example: UEFI Driver - ScsiDiskDxe

edk2/MdeModulePkg/Bus/Scsi/ScsiDiskDxe

- ScsiDiskDxe.inf
- ScsiDisk.c
- ScsiDisk.h

Example: UEFI Driver - ScsiDiskDxe

edk2/MdeModulePkg/Bus/Scsi/ScsiDiskDxe

- ScsiDiskDxe.inf
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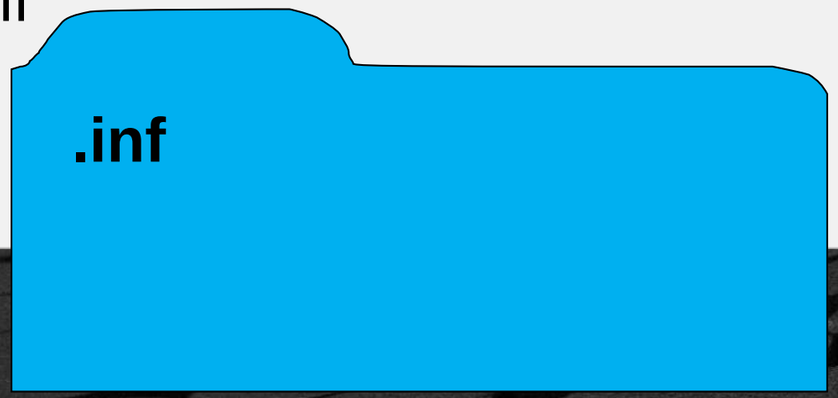


[.inf] Entry, Global Protocols

Example: UEFI Driver - ScsiDiskDxe

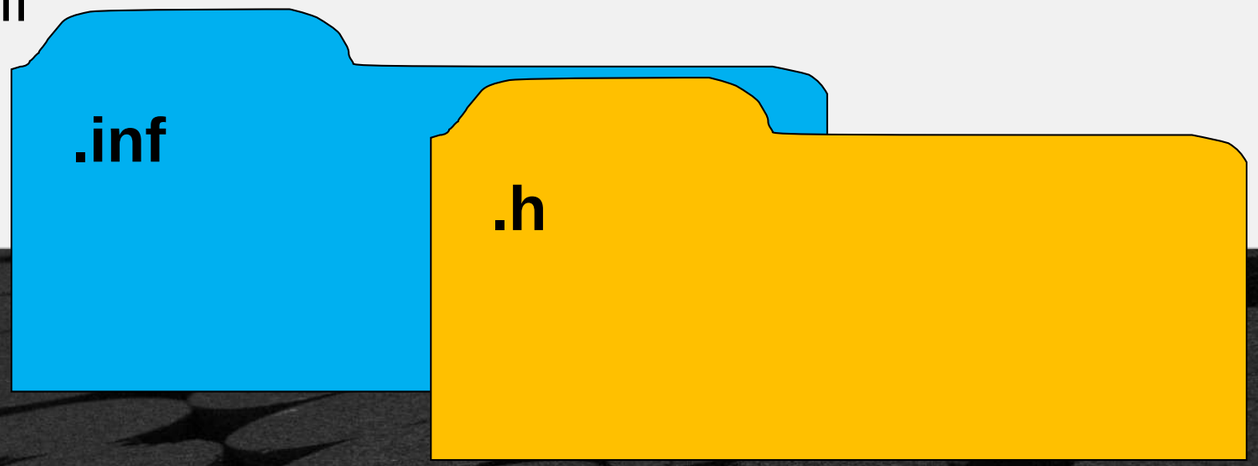
```
[Defines]
  INF_VERSION                    = 0x00010005
  BASE_NAME                      = ScsiDisk
  MODULE_UNI_FILE                = ScsiDisk.uni
  FILE_GUID                      = 0A66E322-3740-4cce-AD62-BD172CECCA35
  MODULE_TYPE                    = UEFI_DRIVER
  VERSION_STRING                 = 1.0

  ENTRY_POINT                    = InitializeScsiDisk

[Sources]
  ComponentName.c
  ScsiDisk.c
  ScsiDisk.h

[Packages]
  MdePkg/MdePkg.dec
```

Link to .inf - Entry point function `InitializeScsiDisk`
`Guids and Protocols`

Example: UEFI Driver - ScsiDiskDxe

edk2/MdeModulePkg/Bus/Scsi/ScsiDiskDxe

- ScsiDiskDxe.inf
- ScsiDisk.c
- ScsiDisk.h



[.inf] Entry, Global Protocols

[.h] Driver’s Private Data Structure declaration

Example: ScsiDisk.h

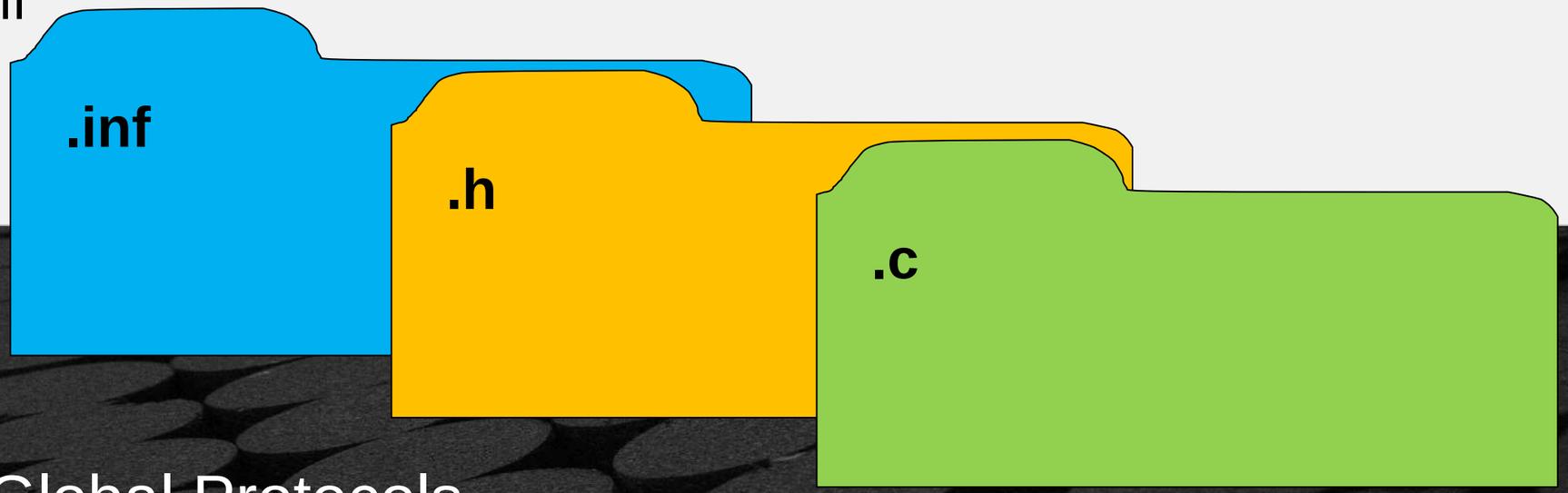
```
#ifndef _SCSI_DISK_H_
#define _SCSI_DISK_H_


#include <Uefi.h>


#include <Protocol/ScsiIo.h>
#include <Protocol/ComponentName.h>
#include <Protocol/BlockIo.h>
#include <Protocol/BlockIo2.h>
#include <Protocol/EraseBlock.h>
#include <Protocol/DriverBinding.h>
#include <Protocol/ScsiPassThruExt.h>
#include <Protocol/ScsiPassThru.h>
#include <Protocol/DiskInfo.h>
```

Link to ScsiDisk.h UEFI Driver's Private Data Structure declaration

Example: UEFI Driver - ScsiDiskDxe

edk2/MdeModulePkg/Bus/Scsi/ScsiDiskDxe

- ScsiDiskDxe.inf
- ScsiDisk.c
- ScsiDisk.h



- [.inf] Entry, Global Protocols
- [.h] Driver’s Private Data Structure declaration
- [.c] Review the Supported, Start and Stop functions

Example: ScsiDisk.c

```
#include "ScsiDisk.h"

EFI_DRIVER_BINDING_PROTOCOL gScsiDiskDriverBinding = {
  ScsiDiskDriverBindingSupported,
  ScsiDiskDriverBindingStart,
  ScsiDiskDriverBindingStop,
  0xa,
  NULL,
  NULL
};

EFI_DISK_INFO_PROTOCOL gScsiDiskInfoProtocolTemplate = {
  EFI_DISK_INFO_SCSI_INTERFACE_GUID,
  ScsiDiskInfoInquiry,
  ScsiDiskInfoIdentify,
  ScsiDiskInfoSenseData,
  ScsiDiskInfoWhichIde
};
```

Link to ScsiDisk.c

Review:

- Driver Binding Protocol
- Initialization Entry point
- Supported
- Start
- Stop

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SUMMARY

- UEFI Drivers manage HW and extend the Firmware
- The UEFI Driver Binding Protocol: Supported, Start and Stop
- Example of UEFI Driver `ScsiDisk` Driver


Questions?

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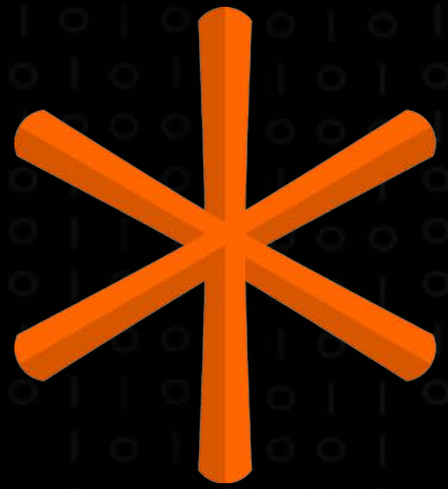

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ACKNOWLEDGEMENTS