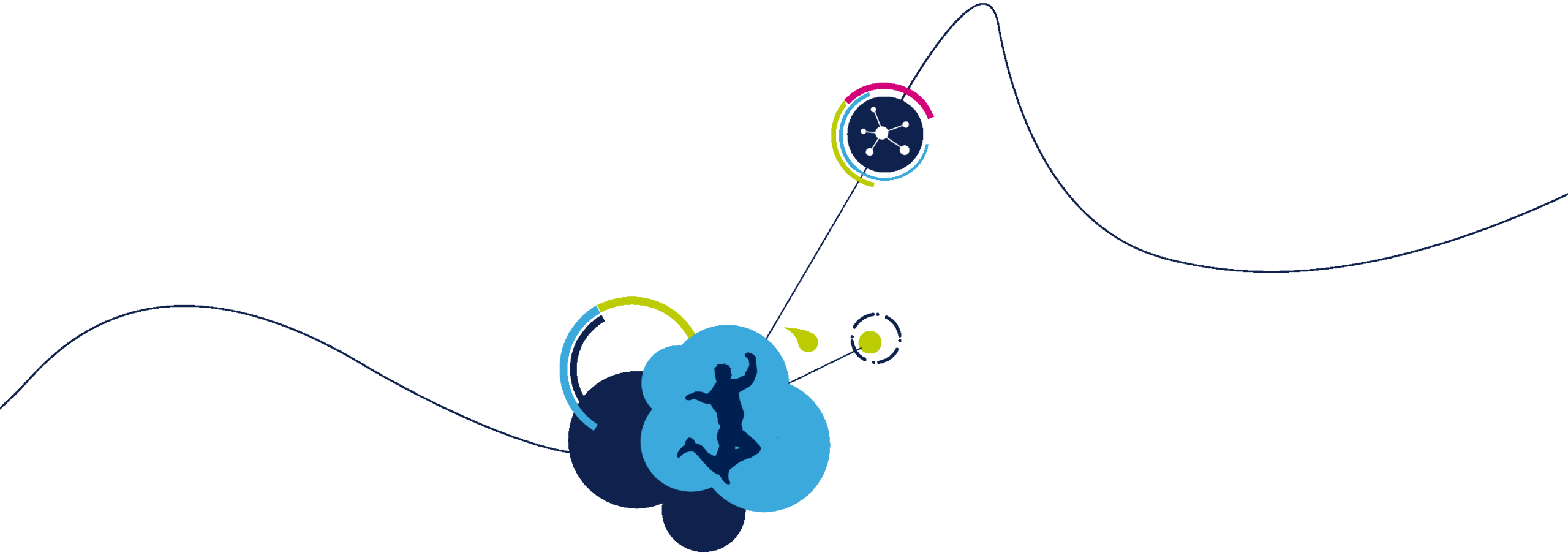


USB drivers for PC

USB drivers development

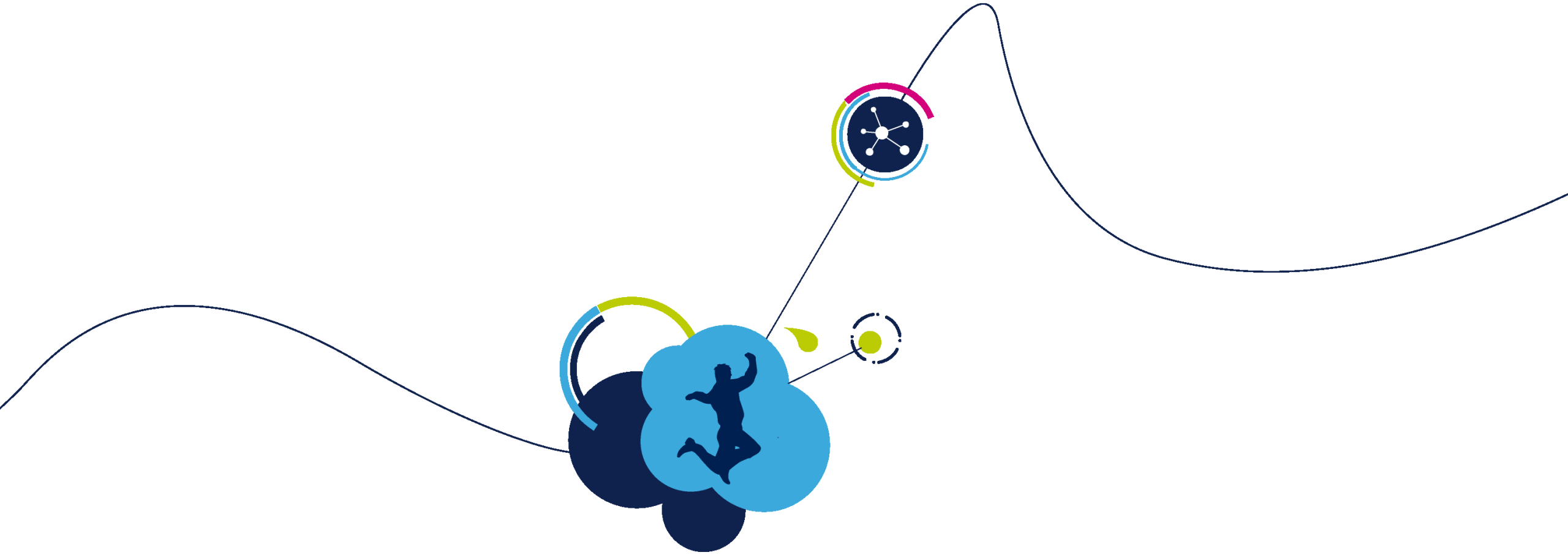
- MS Windows kernel drivers (*.sys)
  - Very difficult to develop and maintain
  - Usage of standard USB class is recommended
    - VCP – Virtual COM Port driver – dedicated slide
    - MSC - Mass storage class – usage of FAT is complicating its usage
    - HID – Human Interface Devices – simple to use, but complex to program, no drivers needed since Win XP
  - Available 3rd parties universal drivers
    - WinUSB (Windows only)
      - Supported since Win XP (W2k not supported)
      - Signature is needed
- Other platforms
  - Linux – no driver is needed, any USB device is connected and can be accessed at low-level. Standard classes supported as well.
  - Libusb – universal solution
    - LGPL license
    - It offers cross-platform implementation of basic USB operations
    - Drivers for major OS
    - Bindings to many programming languages (C/C++, C#, Java etc.)

Win USB drivers

- Structure of Win drivers
  - INF file – description of the driver, defines which kernel driver should be used for particular device defined by the identifiers or connection path
  - CAT – catalog file, it is a package which can contain several files, usually kernel drivers. It can contain also a signature of INF file
  - SYS file – kernel drivers
  - dpinst_XXX – driver installation utility, there are usually two files for x86 and amd64 platforms. Needs to be executed in order to install driver on particular PC
- Windows require signed drivers
  - Older versions can accept unsigned drivers (it shows security warning)
    - To Windows 7 including
    - Windows 8 require special configuration in UEFI bootloader
  - Libusb driver also needs a signature
    - Because they don’t contain VID & PID of the USB device
  - In order to sign a driver, you need a signing certificate

VCP – for MS Win

- Virtual Com port - probably the most used interface with microcontrollers on MS Windows OS
  - Simple data pipe using COM interface, known from MS-DOS programming time
  - Starting from Win 98 till Win 10 – kernel driver (usbser.sys) is available, however INF file needs to be signed
    - possibility to use signed drivers of 3rd parties
    - ST is offering signed INF file (driver), with ST's PID&VID
    - Starting from Win10 signed INF file is NOT needed - check here details
  - Disadvantages
    - Not a plug & play solution, problems with disconnection during transmission
    - Additional communication layer (COM port) and load on PC side
    - As soon as company credentials should be used for the driver identification, signature is needed (< Win10)



Win USB driver digital signature

Which digital certificate

- In order to sign computer software for MS Windows OS there are two options
  - Code Signing Certificate

    + cheaper, easier to obtain
    + possibility to sign SW for Windows
    + Possibility to sign INF installation files for Windows drivers (VCP, WinUSB, UsbLib)
    - ??? Limited expiration, when expires, also the driver signature expires
  - Extended Validity (EV) Code Signing Certificate

    - More expensive, more difficult to get
    ? Certificate is delivered on USB token
    + possibility to sign as above and windows kernel mode drivers
    + needed to be able to put a driver on Windows update service (WHQL)
    + timestamp possibility – driver signature is valid even after certificate itself expires

Where to get digital certificate

- Nice overview at http://www.softwarepublishercertificate.com/
- Kernel mode signing authorities listed here
  - https://docs.microsoft.com/cs-cz/windows-hardware/drivers/install/cross-certificates-for-kernel-mode-code-signing
- In our test case DigiCert certification authority was selected

DigiCert – Code Signing Certificate

- 1-year validity selected
- Process of obtaining
  - You need to prove your identity to certification authority
    - Via officially signed attestation letter in front of notary
    - All available CAs located in USA, in European countries problems with translation (Apostille needed)
    - For the apostille in Czech Republic needed a visit to Ministry of the Interior
  - Skype call and signature of document in front of the certification authority (DigiCert representative)
  - Generation of the asymmetric key pair (public and private keys)
  - Secure storage of the private key
  - Distribution/upload of the public key
  - Process has takes 1 month since order
    - Could be probably shorter, but not less than 1 week
    - Digicert has announced troubles due to high nuber of people asking for certificates in January 2018

DigiCert – Code Signing Certificate

- Certificate installation
  - Described here
  - Install SPC (Software Publisher Certificate) in the Personal Certificate Store (done automatically by Digicert)
  - Backup/Export certificate to a proper device (for example Encrypted USB key), decribeed here

  - Download Cross-Certificate from Microsoft for your CA (Digicert Asure ID in our case) here

Signing process preparation

- Prepare an INF file
  - In our case ST's VCP driver, but with modified PID/VID and company description
- Download Windows Driver Kit
  - Contains two tools you need – Inf2CAT and SignTool
  - Inf2cat tool – generates CAT file (which will be signed)
    - Warning, in the parameter of the exe file, there must be a path to inf file only, not the filename itself

    Example:

```
C:\Program Files (x86)\Windows Kits\10\bin\10.0.16299.0\x86>
Inf2Cat.exe /driver:D:\Projects\IC_VCP\Win8 /os:8_X86,8_X64,6_3_X64,6_3_X86
```

  - SignTool – signs the CAT file

Signing process Inf2Cat

- Inf2cat tool – generates CAT file (which will be signed)
  - Warning, in the parameter of the exe file, there must be a path to inf file only, not the filename itself

Example Win 7 and below:

```
C:\Program Files (x86)\Windows Kits\10\bin\10.0.16299.0\x86>
Inf2Cat.exe /driver:D:\Projects\IC_VCP\Win7
/os:2000,XP_X86,XP_X64,Server2003_X86,Vista_X86,Vista_X64,7_X86,7_X64
```

Example Win8 until Win10:

```
C:\Program Files (x86)\Windows Kits\10\bin\10.0.16299.0\x86>
Inf2Cat.exe /driver:D:\Projects\IC_VCP\Win8 /os:8_X86,8_X64,6_3_X64,6_3_X86
```

Note for VCP driver: The difference between Win7 and Win8 is in the handling of cab files where the usbser.sys file is stored, therefore two different inf files are needed

Signing process SignTool

- SignTool – signs the CAT file

Example:

```
SignTool sign /ac "DigiCert Assured ID Root CA.crt" /s My /n "Ivo
Cisar" /t http://timestamp.verisign.com/scripts/timstamp.dll
d:\Projects\IC_VCP\Win7\iccdc.cat
```

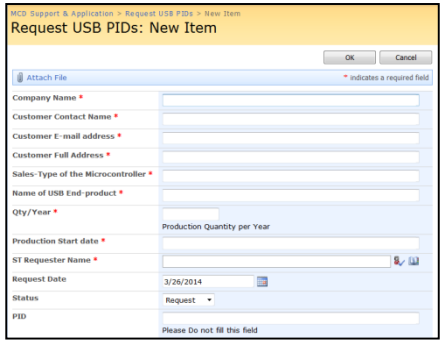
That's it …

Obtaining VID & PID from USB-IF

- Requires membership in USB-IF
  - Annual membership fee is US$4,000
- You get assigned unique VID and you can assign PIDs on your own
- Possibility to sublicense PID from ST
  - You need to use VID for ST (0x0483)
  - You can’t use USB logo

USB VID/PID sublicensing service

Process & Schedule for PID request



- Request details:
  1) COMPANY NAME AUTHORZING USE TO :
  2) Contact Name /Address and E-mail address:
  3) Name/Sales type of the STMicrocontroller product name :
  4) Name of USB end-product : { if possible USB device string Product}
- PID Booked in an internal ST Database
- By end of each quarter
  - ST send the approval list to the USB-IF
  - Approval by USB-IF
  - PID send to the customer with a “letter form Agreement”