

Changes in Extreme Precipitation and Temperature Indices over two Alpine Regions using CMIP5 Climate Models

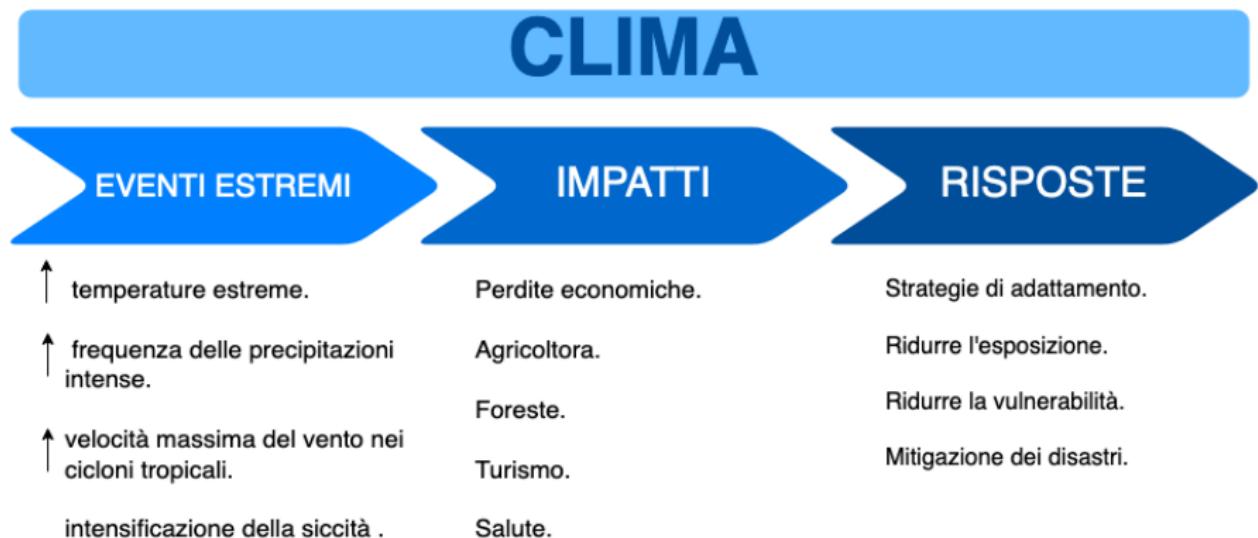
Daniela Andrea Quintero Garcia

Department of Environment, Land and Infrastructure Engineering
Politecnico di Torino

July 22, 2020



Motivation



Outline

1. Introduzione
2. CMIP5 Models
3. Climate Change Indices ETCCDI
4. Regioni
5. Data Processing
6. Risultati
7. Conclusioni
8. Lavori Futuri

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Introduzione

Studiare gli eventi estremi è di grande importanza per sviluppare meglio la gestione del rischio di disastri, ridurre l'esposizione e la vulnerabilità della società.

Questa tesi studia i cambiamenti dei modelli climatici CMIP5 applicando gli indici climatici ETCCDI per le precipitazioni e la temperatura in due aree alpine.

The SEcube™ Open Security Platform

Hardware

Software

The SEcube™ Open Security Platform

Hardware

Software

Developed by the Blu5
Group

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Hardware

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Family

- ▶ SEcube™ Chip
- ▶ SEcube™ DevKit
- ▶ USEcube™ Stick

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- ▶ **MCU:** STM32F4 (STM)
- ▶ **FPGA:** MachXO2-7000 (Lattice)
- ▶ **Smart Card:** SLJ52G (infineon)

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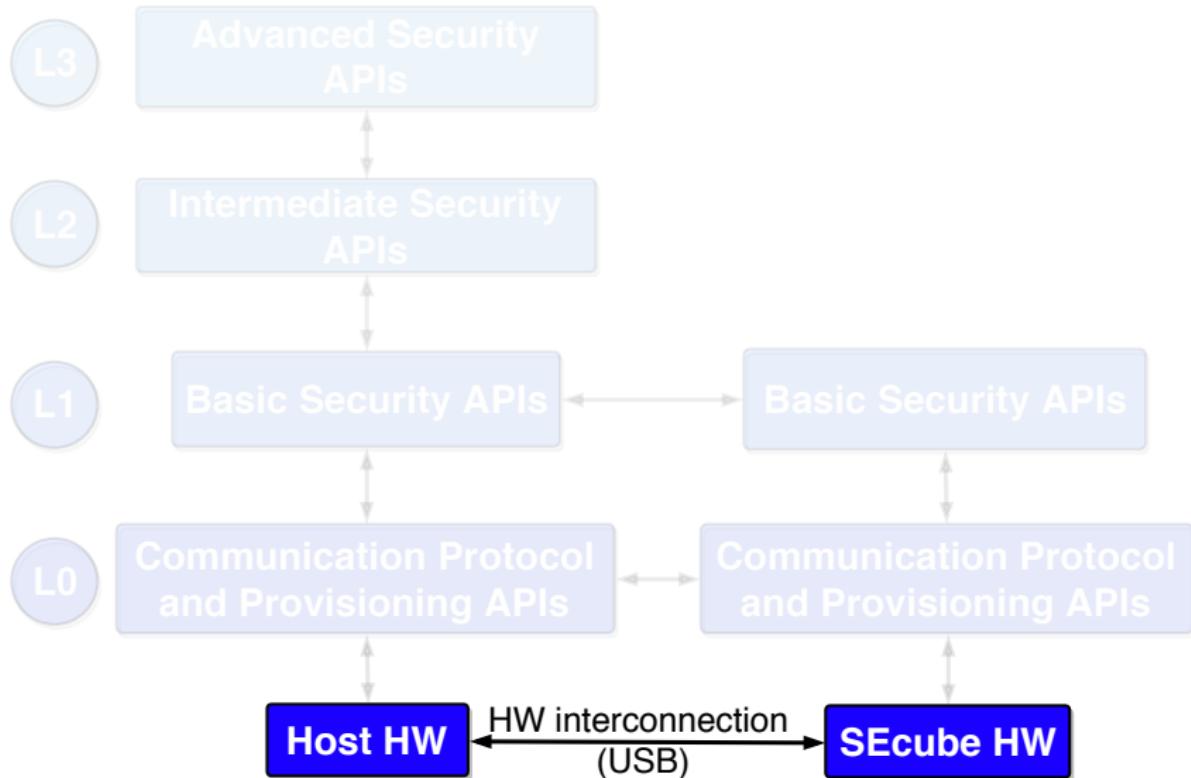
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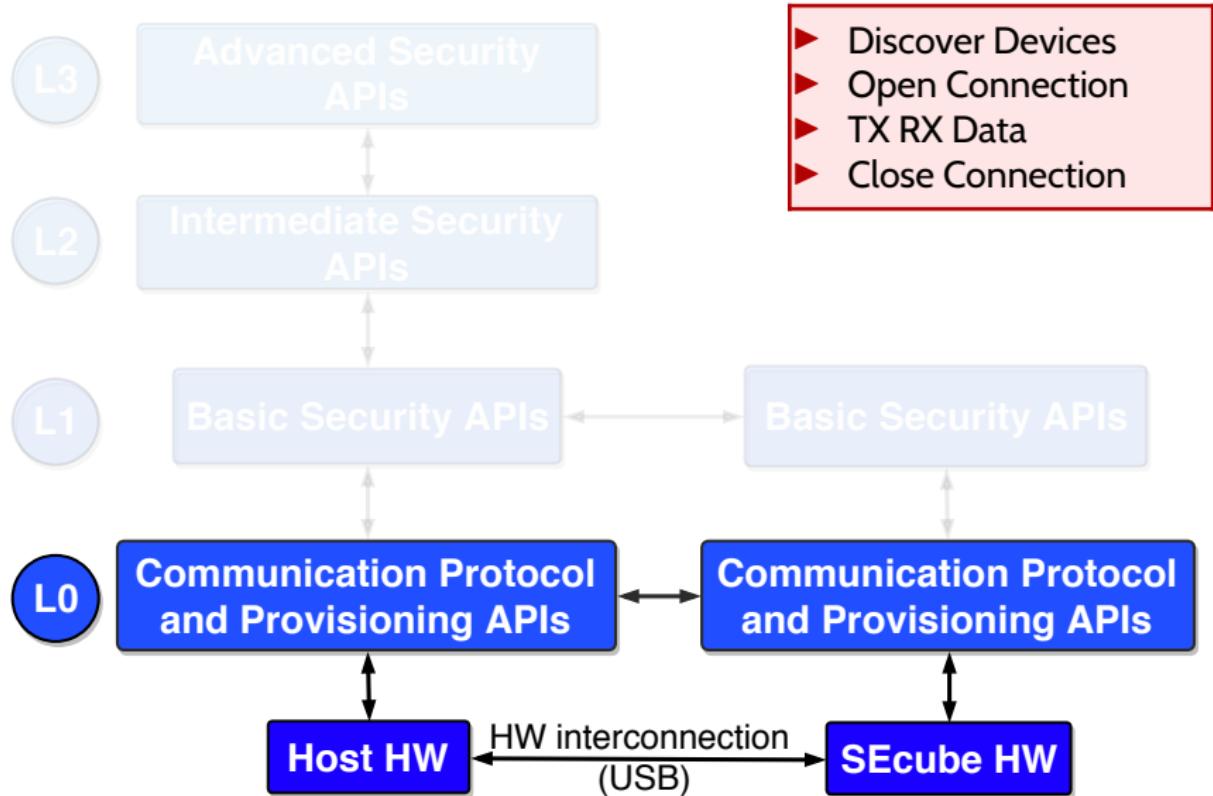
Firmware: Developers can customize the firmware to their needs, and load the updated version to the SEcube™ chip.

Host libraries: Allow to experience the platform as a high-security black box.

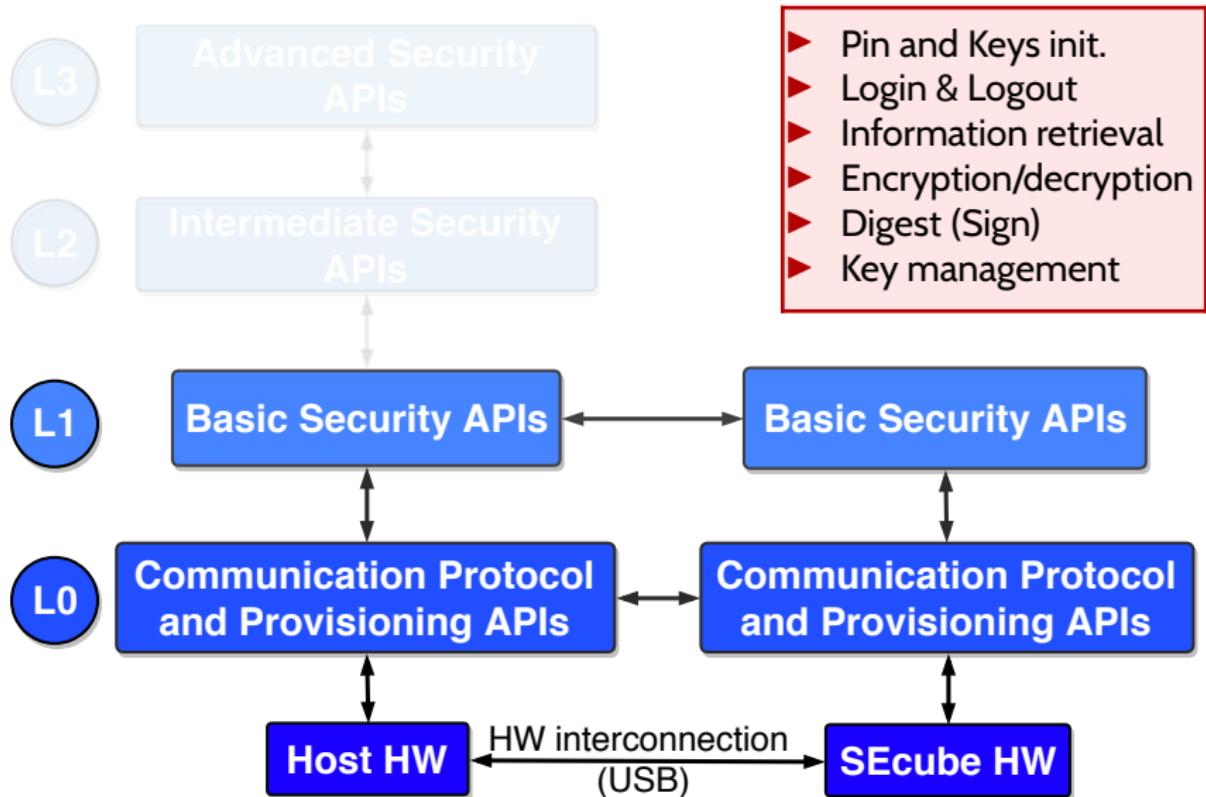
SEcube™ APIs hierarchy



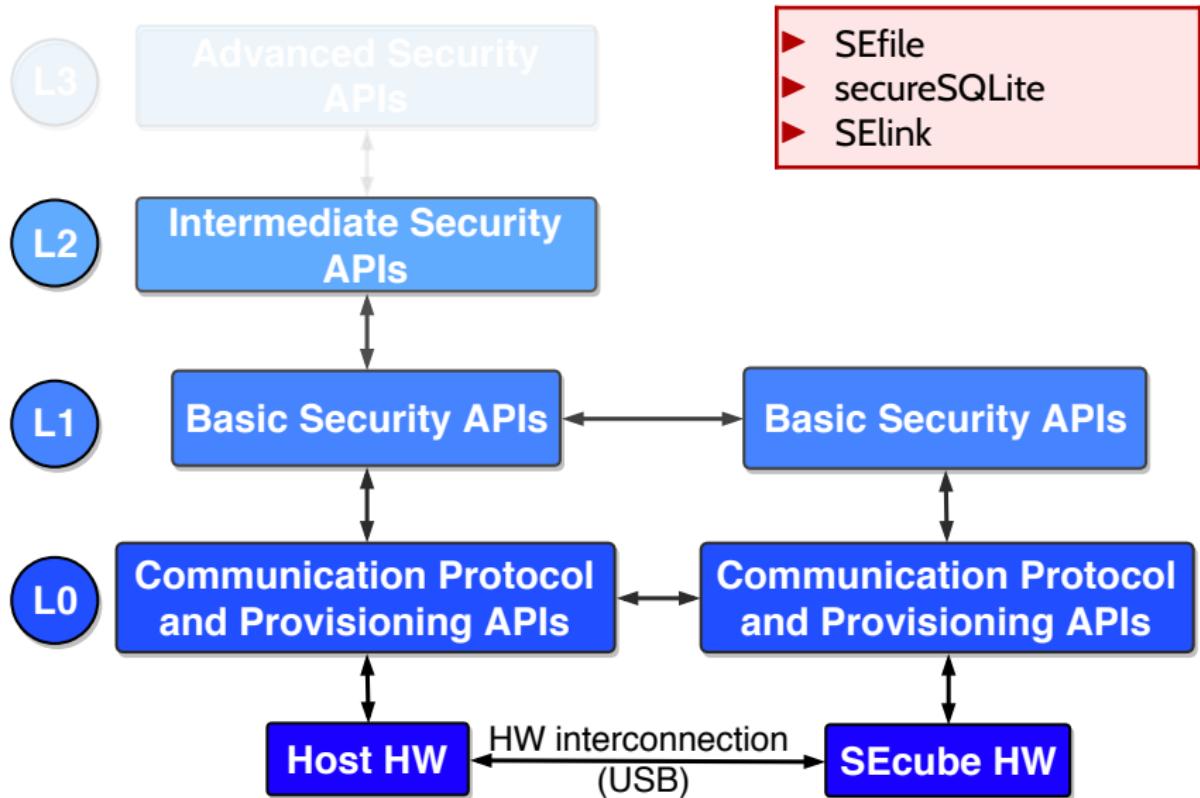
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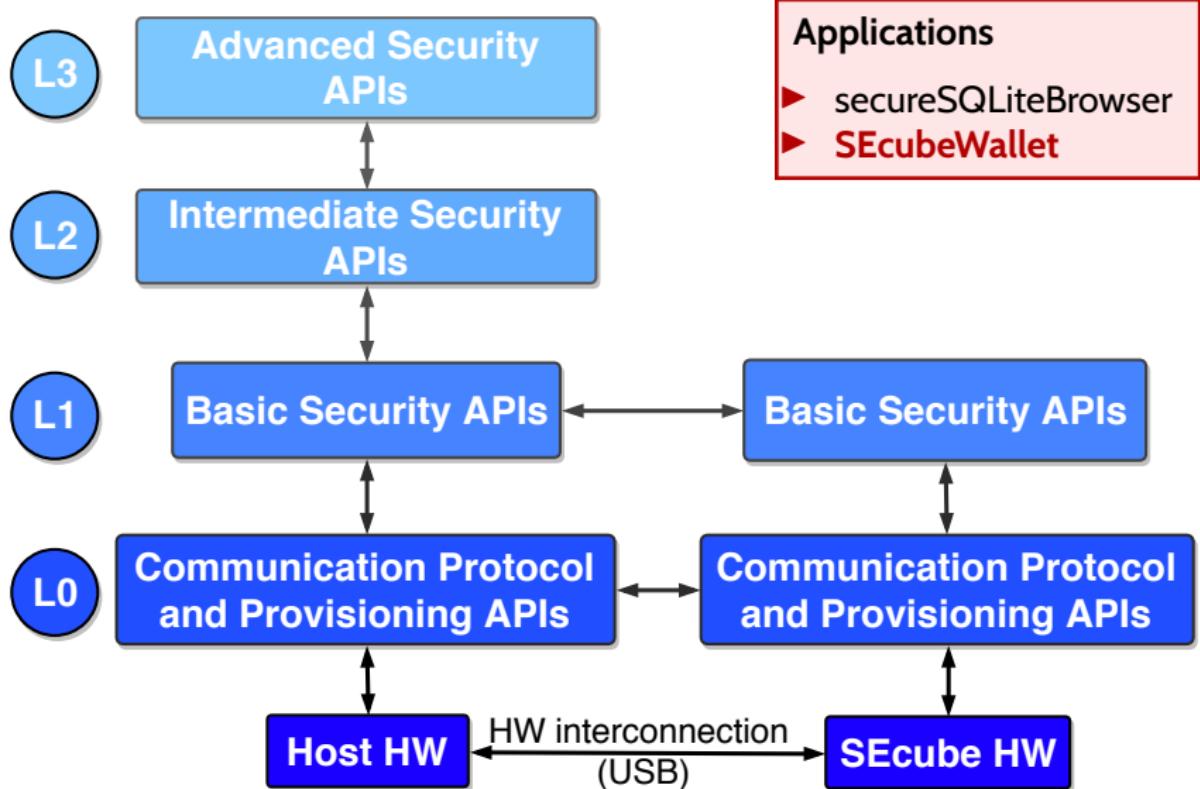
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CMIP5 Models

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- ▶ Set di dati multi-modello progettato per aumentare la nostra conoscenza del clima, la sua variabilità e il suo cambiamento attraverso l'applicazione di GCMs:

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 - ▶ Integrazione a lungo termine.
 - ▶ Sperimento storico (1850-2005).
 - ▶ Proiezioni futuri RCP2.6, RCP4.5, RCP6.0 e RCP8.5 (2006-2100).
 - ▶ Integrazione a breve termine.

CMIP5 Models

Variable	Frequency	Experiment	N° Models	Analysis
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		RCP4.5	31	
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pr tas	Monthly	Historical	49	Evaluation of models and change in precipitation and temperature
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		RCP8.5	42	

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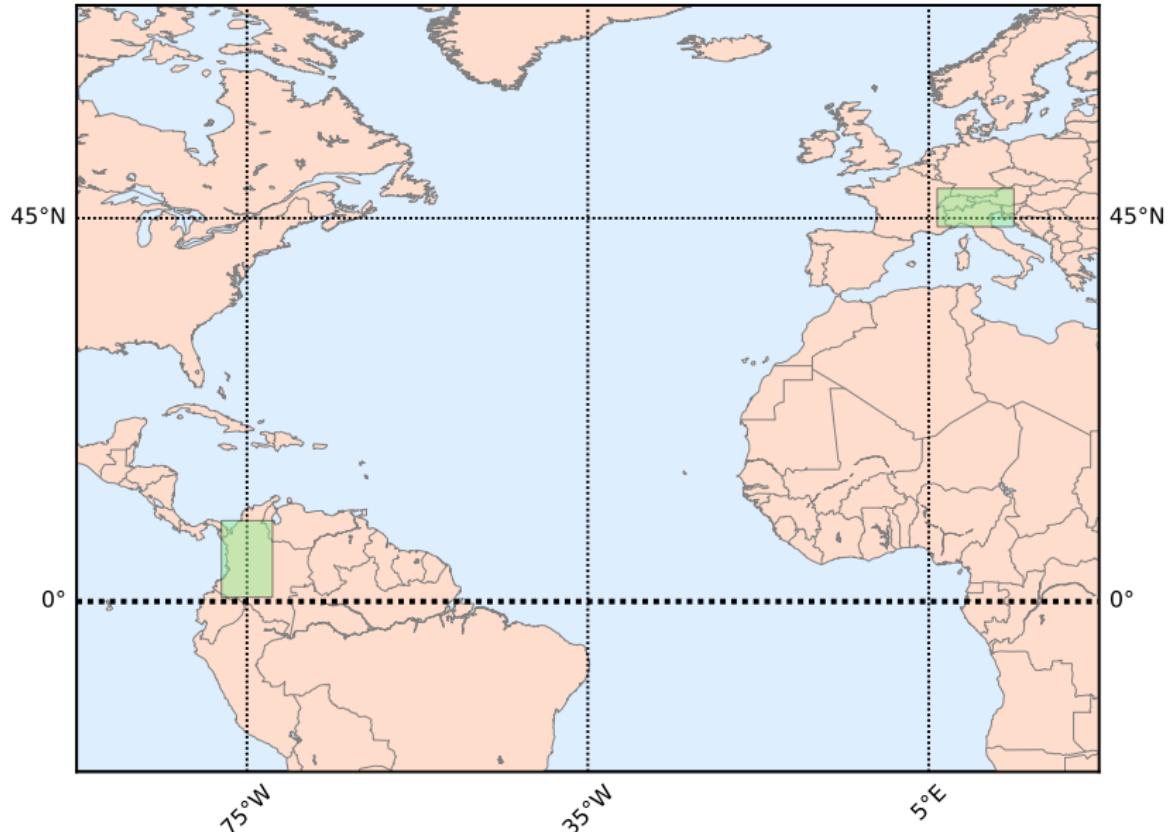
Percentiles

Percentuali di superamento al di sopra o al di sotto del 10th o 90th percentile.

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Regioni



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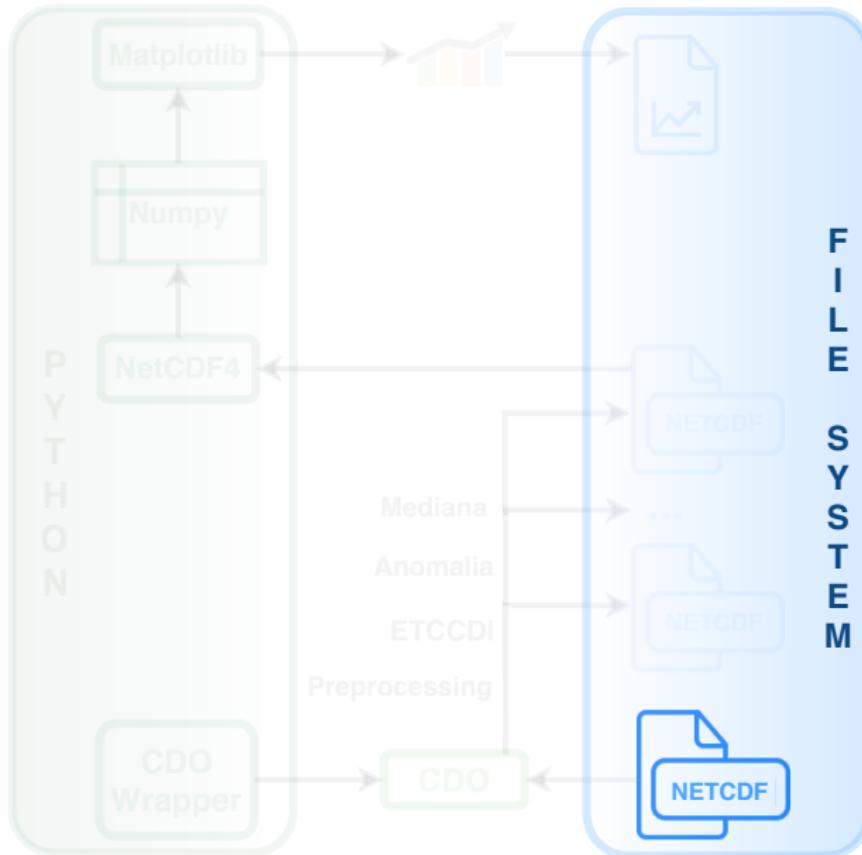
Regioni



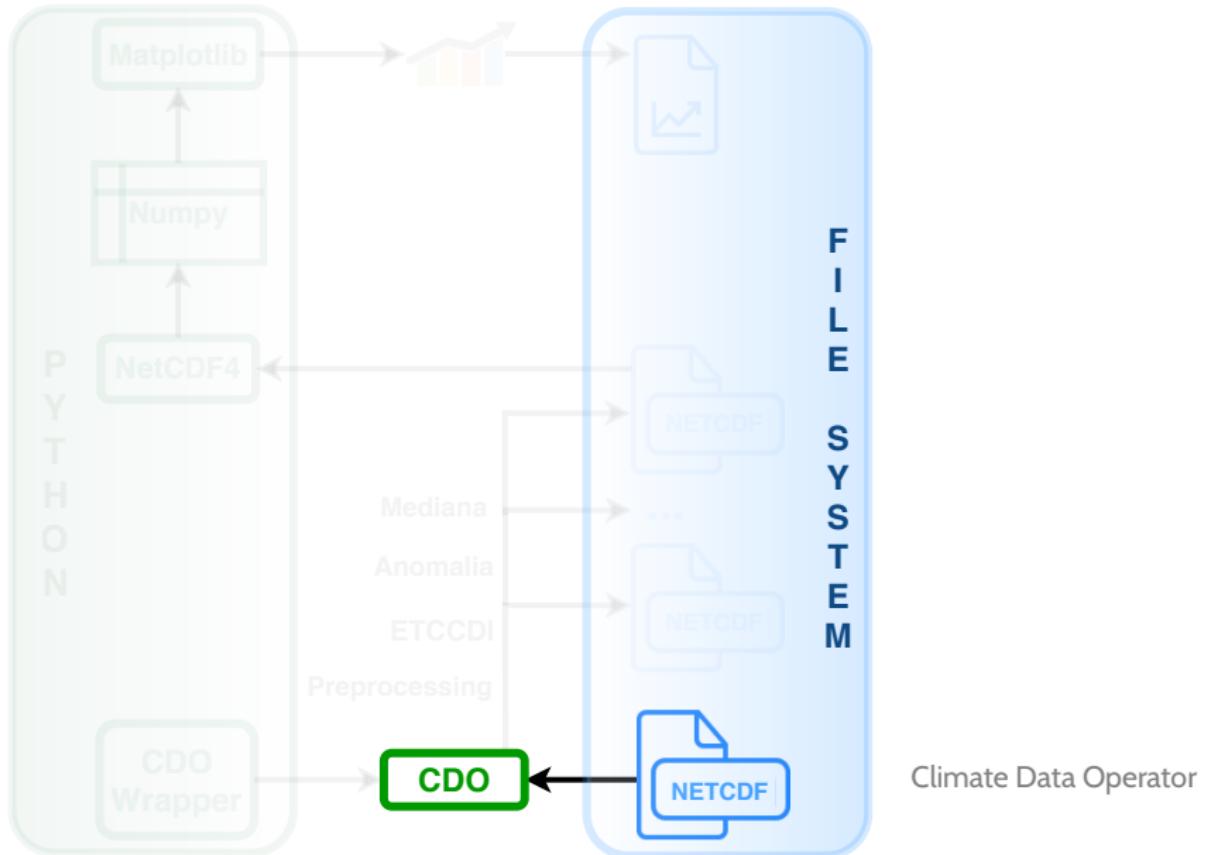
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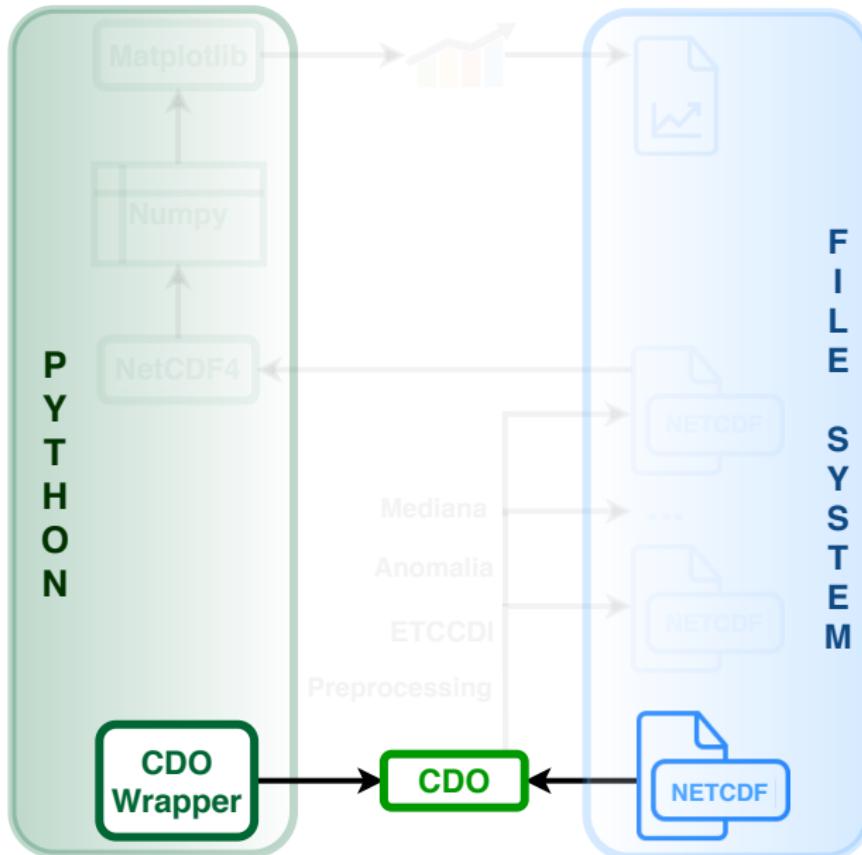
Data Processing



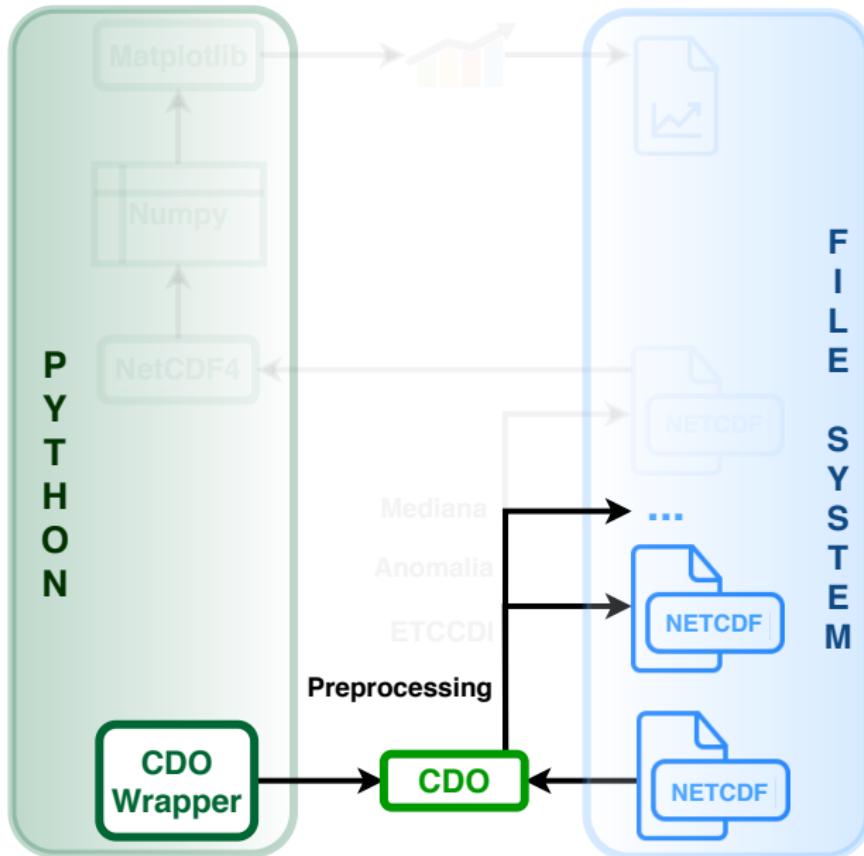
Data Processing



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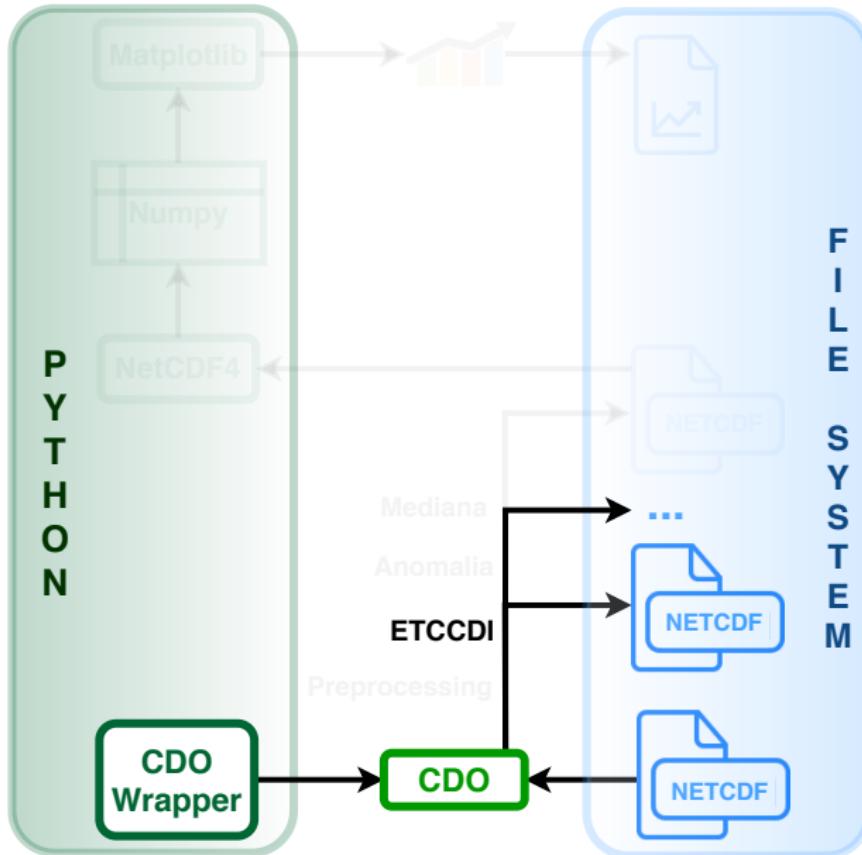


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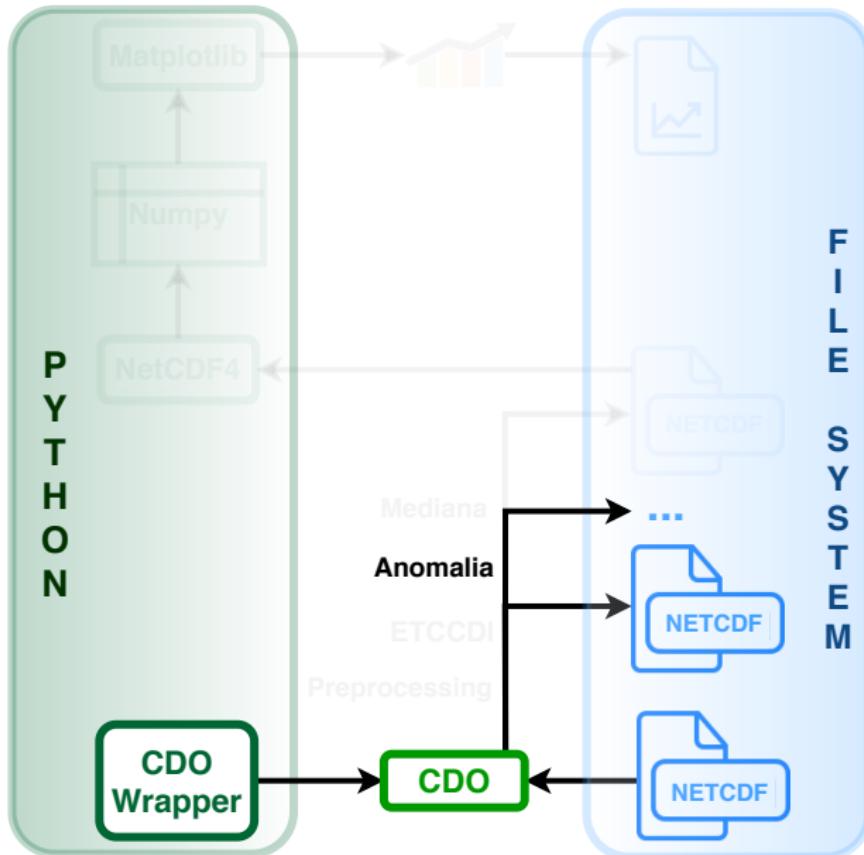


- Regione
- Calendario
- Unità
- Mergetime

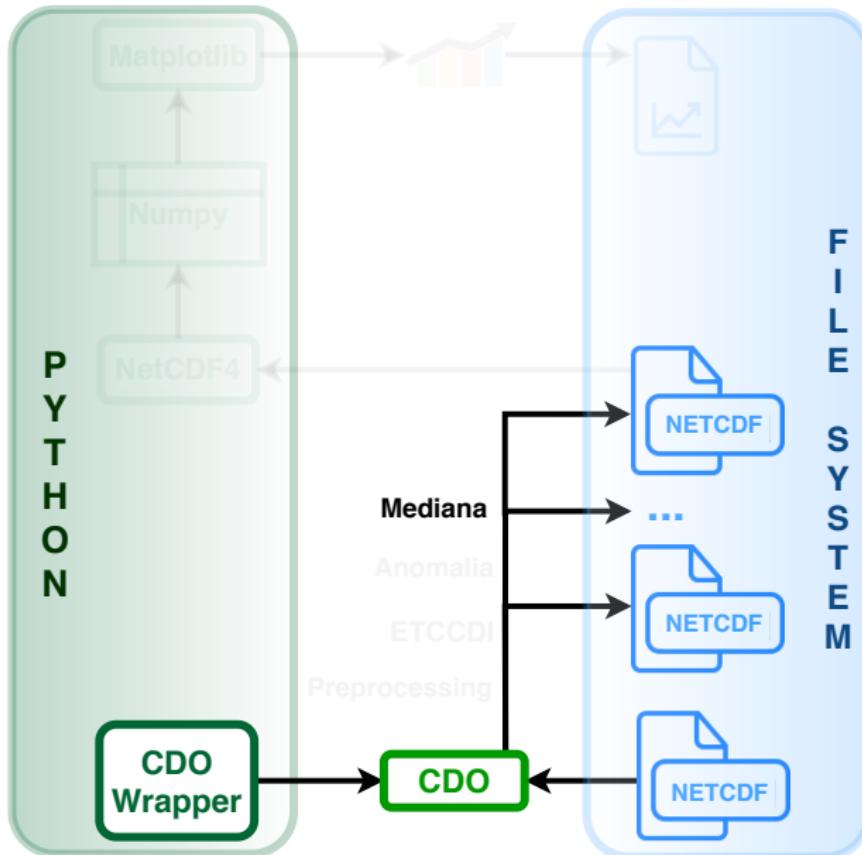
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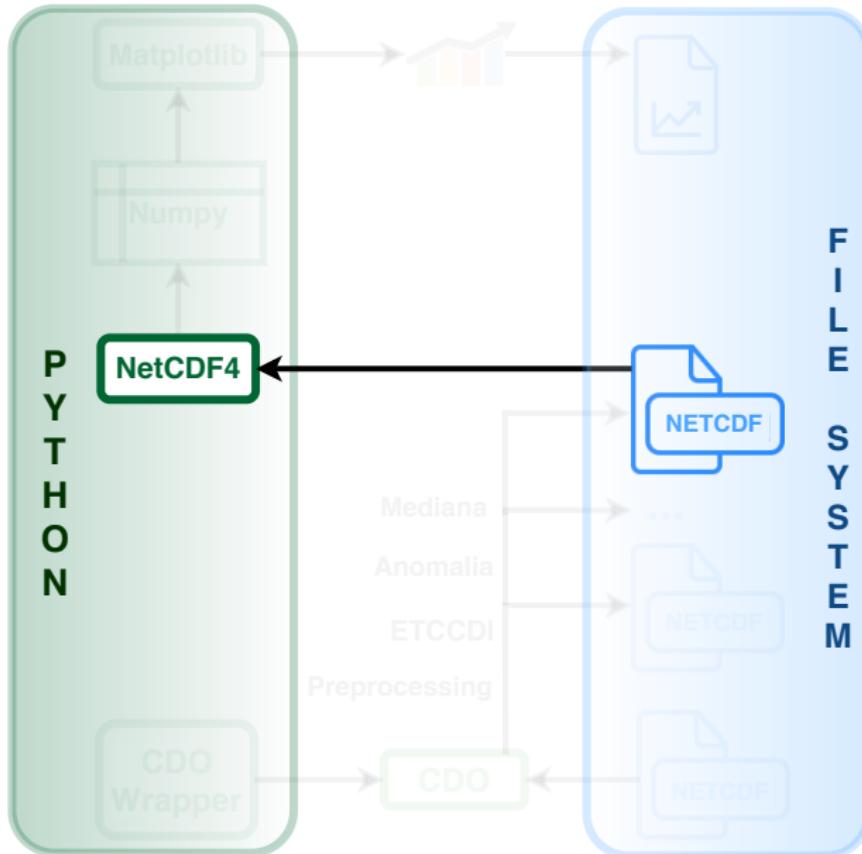
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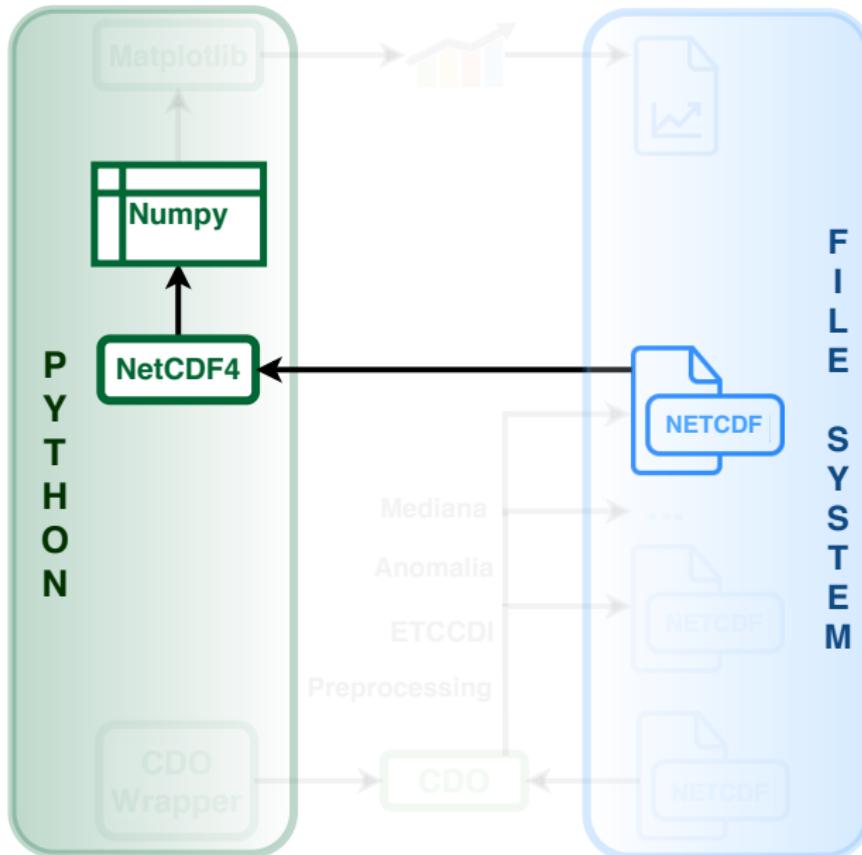
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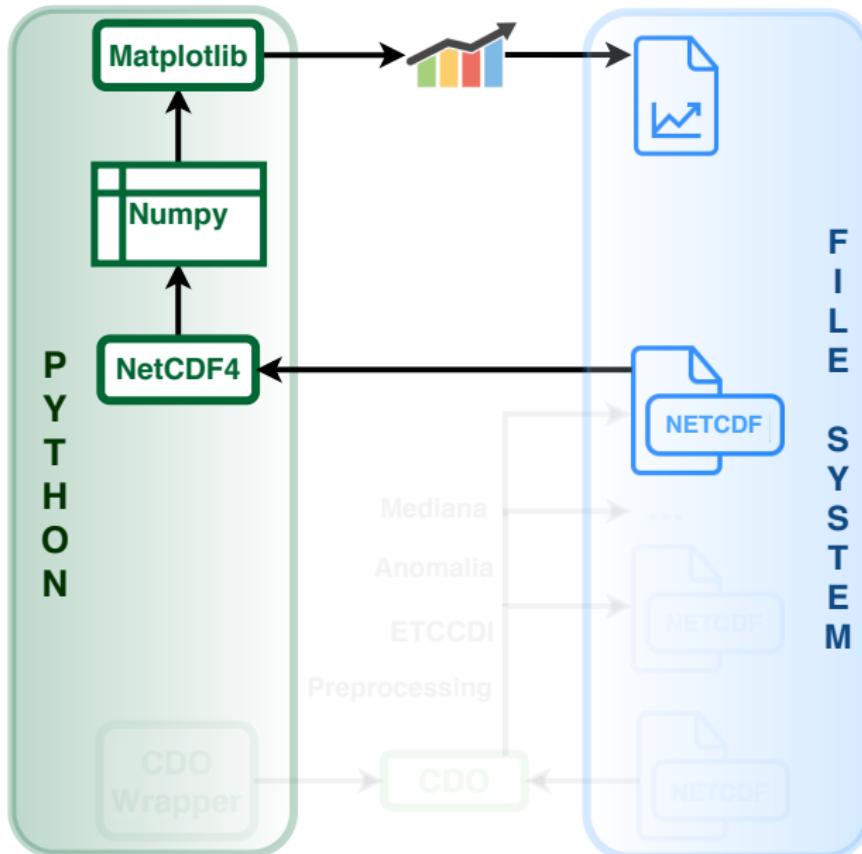
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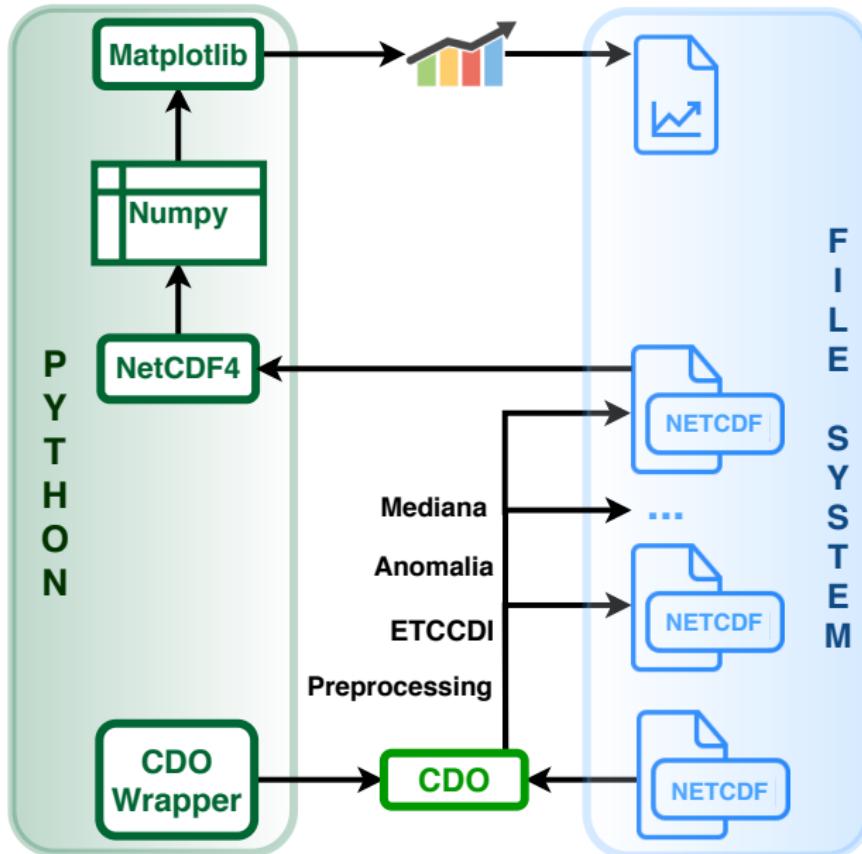


Data Processing



Serie Storica
Mappa
Grafico a Barre

Data Processing



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Login and Open a Wallet



Generate and evaluate password



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Conclusions

- ▶ The SEcube™ is perfect for this type of application as it offers both reliability and simplicity to use.
- ▶ In any password manager it is important to suggest random passwords and to check their strength
- ▶ All the used libraries in this project are open source, proving it is possible to achieve a high level of security with the use of open software and hardware tools.
- ▶ The developed application still lacks some features in order to be considered a truly commercial product.

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Future Work

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Web Browse Integration

- ▶ Develop a web browser complement.
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More than static passwords

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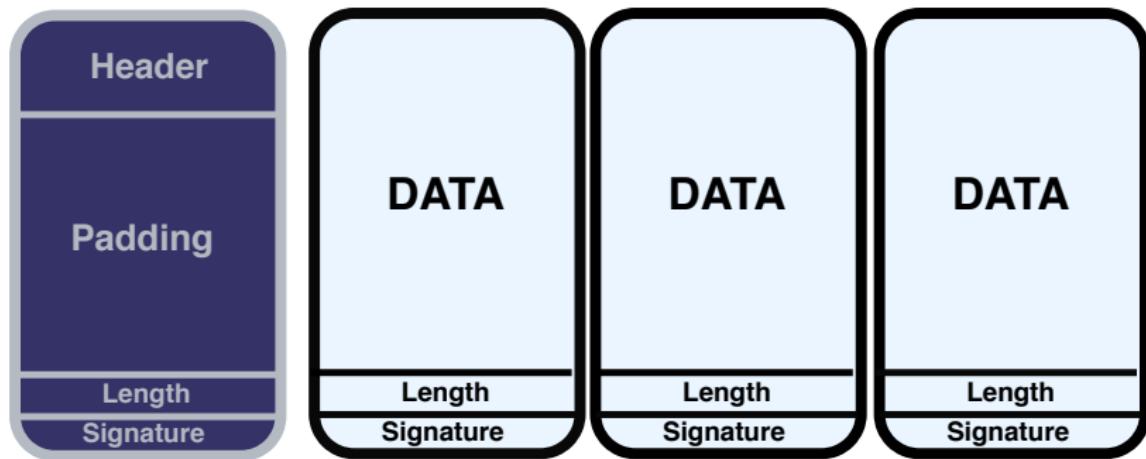
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Android

- ▶ Use a SEcube™ phone device
- ▶ Port SEcube™ host-side libraries to android
- ▶ Port Qt application to android

SEfile

A secured file has the structure shown in figure. The data is divided in sectors, and each of them is encrypted and signed. The first sector (header) contains metadata. When a portion of the file wants to be read or written, it is not necessary to process the whole file. Only the required sectors are manipulated.



Algorithms

Encryption: Advanced Encryption Standard (AES), established by the U.S. National Institute of Standards and Technology (NIST). For each data sector **AES-256-CTR** is used, while the header sector is encrypted using **AES-256-ECB**.

Authentication Each sector, including the header, is signed using **SHA-256-HMAC**, meaning that the signature depends on both the data contained in the sector itself and on a chosen encryption key.

To use two different keys to encrypt data and to digest authentication. SEfile leverages on the pbkdf2()

secureSQLite

Based on the [SQLite](#) and [SEfile](#), this API allows the user to create SEcube™ secured data bases.

The SQLite system has been modified to use a wrapper based on SEfile, rather than using directly the OS calls. The development is based on a template for making a custom [VFS](#) interface distributed along with SQLite.

Every database created with secureSQLite is cyphered and signed, thus making it impossible to read the database contents without the SEcube™.

Development Board

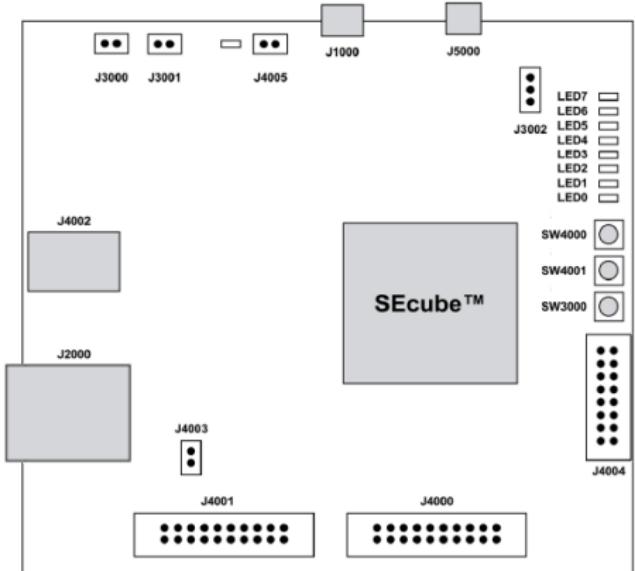
J1000 USB 2.0 to UART

J2000 Ethernet 10/100

J4000 FPGA and CPU GPIOs

J4001 JTAG

J4002 microSD card

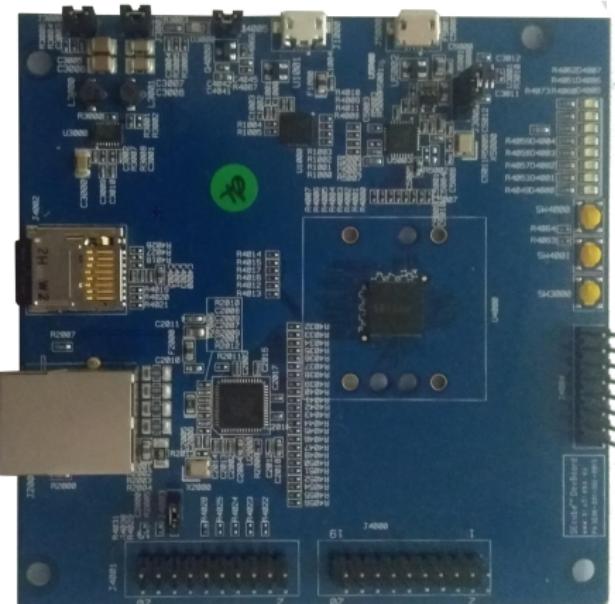


J4004 FPGA and CPU GPIOs

J5000 USB 2.0 High Speed

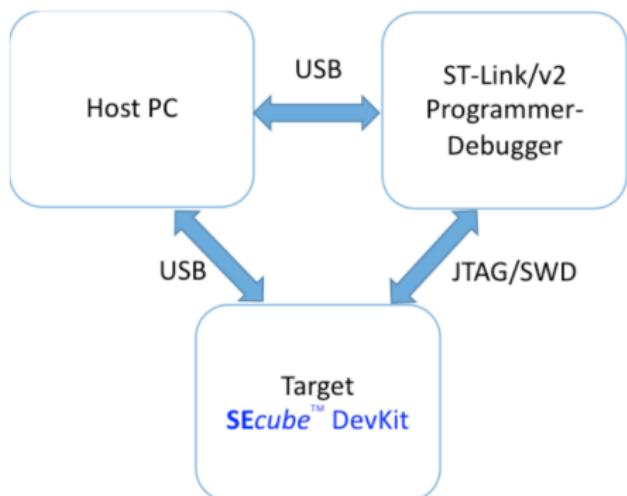
LEDx Leds

SWxOOy Switches



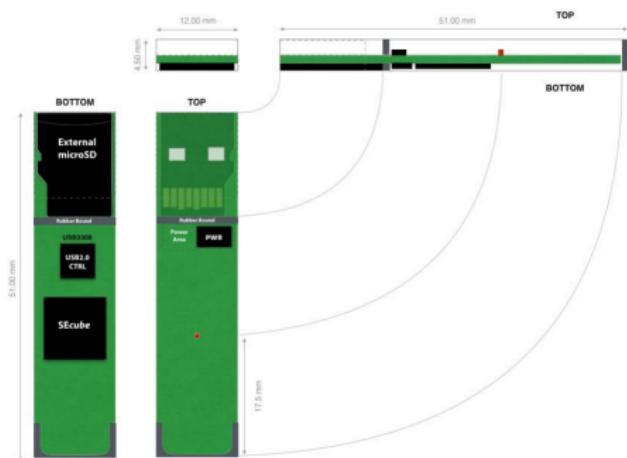
JTAG Connections

To program and debug the chip, we use an **ST-Link/V2** which communicates with the MCU using the JTAG/SWD connection in the DevKit board.



The USEcube™ Stick

- ▶ SEcube™ chip + USB 2.0 High-Speed + SDcard socket.
- ▶ Compatible with any Operating System, and no need for drivers.
- ▶ Separation of encrypted data from the encryptor/decryptor.
- ▶ microSD can be changed to adjust size and speed.
- ▶ Dust and water-resistant
- ▶ No JTAG interface. To inject firmware, secure bootloader.



YubiKey

Family of hardware authentication devices developed by Yubico
Unfortunately, not open source.

Supports Google Accounts, Facebook Accounts, GitHub, Dropbox

- ▶ Static Passwords
- ▶ Yubico One-Time Password (OTP)
- ▶ OATH – HOTP (EVENT)
- ▶ OATH – TOTP (TIME)
- ▶ Challenge and Response (HMAC-SHA1, Yubico OTP)
- ▶ PIV-Compatible Smart Card:
- ▶ OpenPGP
- ▶ FIDO U2F



Mooltipass: A Simple Offline Password Keeper

The Mooltipass emulates a standard USB keyboard, The Mooltipass has an internal flash in which the user encrypted credentials are stored, while a PIN-locked smartcard contains the AES-256bits key required for their decryption. Open software and open hardware, kickstarter campaign.

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- ▶ ST662ACD-TR: Power
 - ▶ ATMEGA32U4: MCU
 - ▶ AT88SC102: Smart Card
 - ▶ AT45DB011D-SSH-T: Flash



PwGen Examples

-s: Random
-y: Symbols
-v: No vowels

-B: No ambiguous
-A: No capital
-0: No numerals

Password	Length	Options	Log Entropy
iesohGhai3	10	-	9.75 (Level 3)
ees0cooLo2	10	-	10.47 (Level 4)
dX042wKqlW	10	-s	17.86 (Level 4)
@! ,Q*15}+H	10	-ys	18.15 (Level 4)
TBw4)9	6	-ys	11.62 (Level 4)
B7t34Lck	8	-v	11.87 (Level 4)
nofosootei	10	-BA0	6.50 (Level 2)

PassPhrase Generator examples

PassPhrase	wor	len	uncom	Log Entr
Cocchio	1	-	-	4.27 (L1)
Legitimately	1	8	-	4.55 (L1)
Woodhaven	1	8	30%	4.94 (L1)
ShorelineCech	2	-	-	9.18 (L3)
MongoliaSimpsons	2	8	-	7.30 (L2)
McinnisPhaya	2	-	30%	9.14 (L3)
ZucchiniSalamandra	2	8	30%	9.19 (L3)
SacchettiVigevano	2	8	30%	9.11 (L3)
DrammaturgicoSbatacchiare	2	12	-	8.98 (L3)
MalformationsAstrophysical	2	12	-	9.60 (L3)
LatinalInterchangeFbo	3	-	-	13.5 (L4)
OsaAymanCantinflas	3	-	-	12.98 (L4)
ImmobileCwSites	3	-	-	11.43 (L4)
RimmelBragFaenza	3	-	30%	13.49 (L4)
RecliningCanberraEcuadorian	3	8	-	13.69 (L4)
InaspettatoRothschildsDisconcerting	3	8	30%	14.48 (L4)

Other contributions

Besides the application development, other results obtained during this work are:

- ▶ The implementation of an improved Login behaviour in the SEcube™ framework, that renders more usable SEcubeWallet and any other application that uses the SEcube™ authentication system.
- ▶ The discovery and fix of a bug in the SEfile library that did not allow to use the secureSQLite library in a FAT32 file system.

SEkey: key management for SEcube™

SEkey is a new library currently under development by Mateus Fran ani as his master thesis work. The library will sit next to SEfile and SElink.

Right now keys inside a SEcube™ chip can only be modified at factory reset. This is not very useful in a working environment, as the purpose of having multiple keys is to allow users to share information with selected people.

The job of the SEkey library will be to allow an admin to dynamically add and remove keys to SEcube™ devices.

