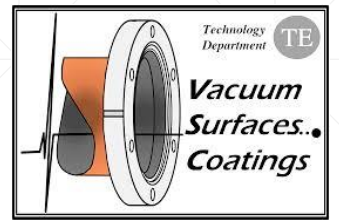


FCT

Fundação para a Ciência e a Tecnologia



Software Development for Vacuum Controls – SCADA Functions Development



FCT Trainee: Rebelo, João

Informatics Engineer – Faculty of Science of the University of Lisbon

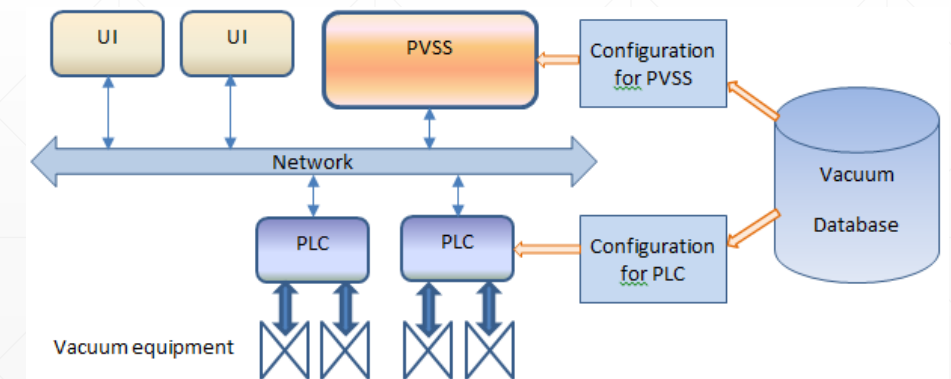
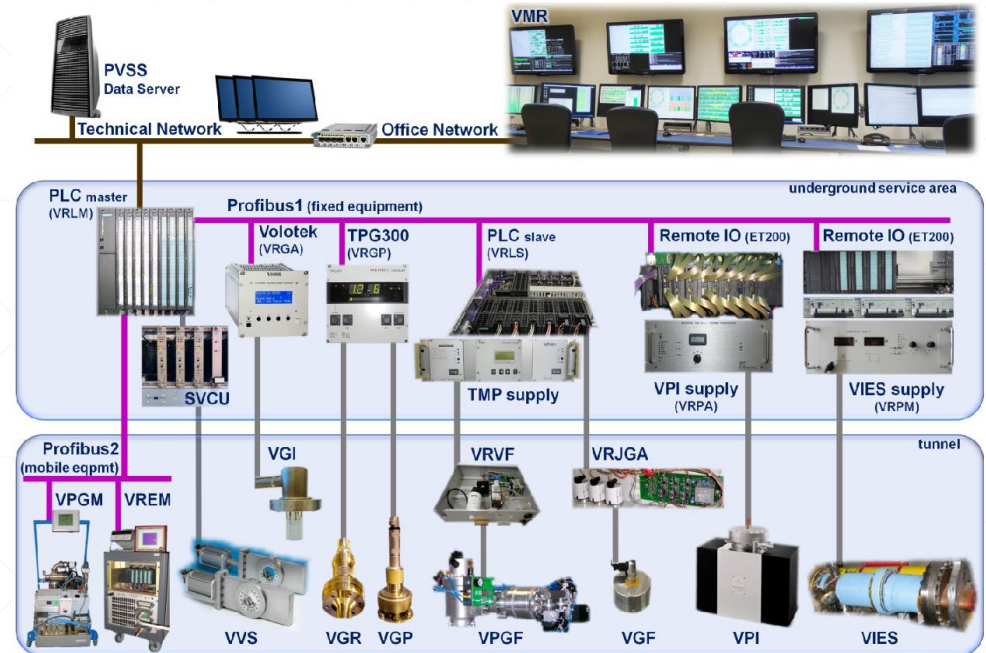
Starting date at CERN: 01/04/2019

Supervisor: Rocha, André

TE-VSC-ICM

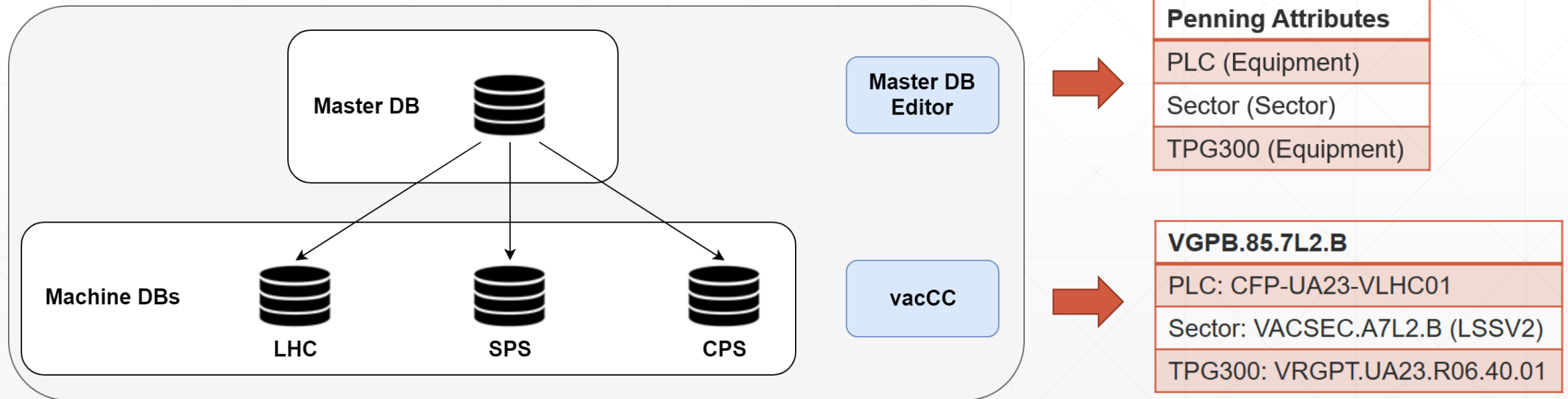
Context – Vacuum at CERN

- With over 128km of vacuum chambers, CERN is home to the largest vacuum system in the world
- The underlying architecture comprises approximately
 - 15 000 pieces of control equipment
 - 300 Programmable Logic Controllers (PLCs)
 - 7 Supervisory Control and Data Acquisition (SCADA) servers
- Vacuum Control System
 - Vacuum Database (vacDB) contains information of all devices in the system
 - Device information is used to generate configuration files used by PLCs and PVSS (SCADA)



Vacuum Control System

- In order to modify vacDB (Vacuum Database) in a user friendly and safe way, 2 applications (the vacuum DB editors) were developed over 15 years ago
 - Master DB Editor – Edit metadata common to all machine databases
 - Some examples are: Attribute Types, Data Point Types, Control Types, etc.
 - vacCC (Vacuum Control Configurator) – Integrate and modify the vacuum devices within the control system
 - Export configuration files for the communication between vacuum devices and the supervision system



Team Integration and Framework Familiarization


- To familiarize myself with the Vacuum Control System Framework I started to do some bug fixes and improvements in vacCC application
- My main project is the renovation of the Master DB Editor. Some of the tasks already concluded are:
 - Produced a database analysis document
 - Studied the design of the legacy Master DB Editor
 - Produced a diagram of the database schema

CERN
CH-1211 Geneva 23
Switzerland

TE Technology Department

CERN TE/Group TE-VSC-ICM

EDMS Document No.
v.0.0

 Vacuum Control Monitoring

vacMaster DB Editor Renovation

Match between UIs and database tables/views


Prepared by : J. REBELO	Checked by : A. PAIVA E ROCHA I. AMADOR	Approved by : A. PAIVA E ROCHA
-----------------------------------	--	--

CERN
CH-1211 Geneva 23
Switzerland

TE Technology Department

CERN TE/Group TE-VSC-ICM

EDMS Document No.
v.0.0

 Vacuum Control Monitoring

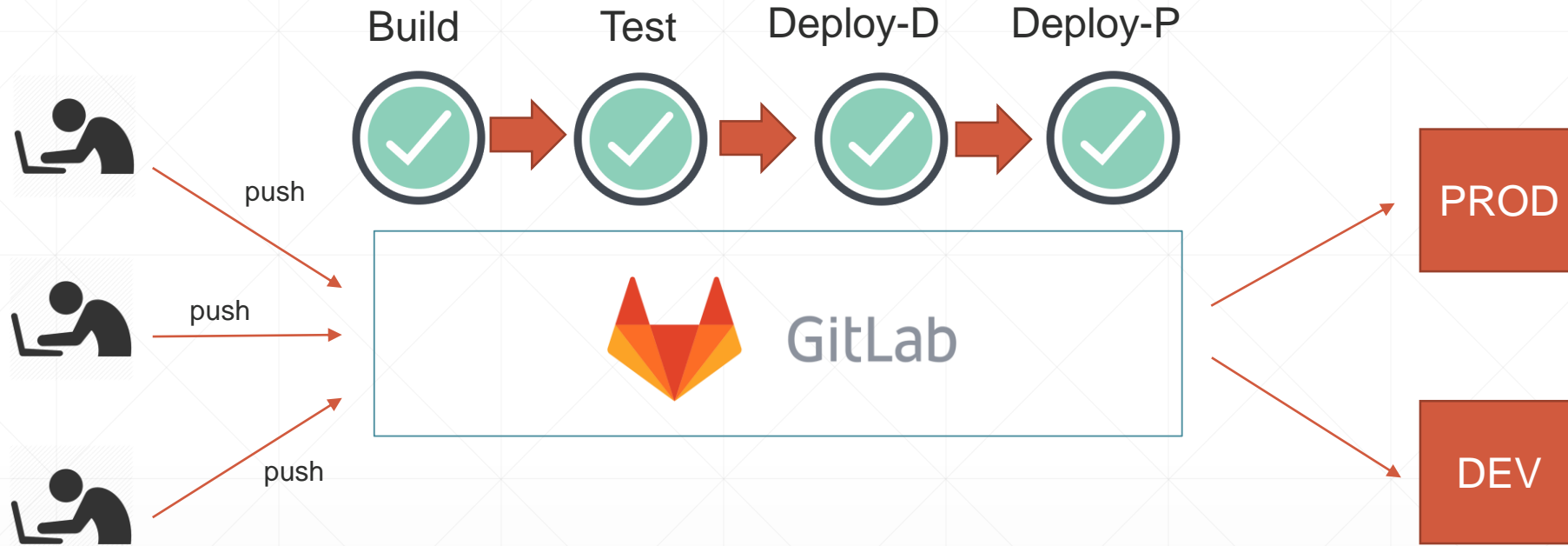
vacMaster DB Editor Renovation

Features and UIs to be developed

Prepared by : J. REBELO	Checked by : A. PAIVA E ROCHA I. AMADOR	Approved by : A. PAIVA E ROCHA
-----------------------------------	--	--

Software Development

- Built Continuous Integration pipelines



- Built the first skeleton of the application. Built both backend and frontend, as well as security features
- Built functioning prototypes using two different frontend UI frameworks
 - Analyzed both versions in order to pick the most appropriate one for the rest of the development

Projects – Master DB Editor

- “DP Types & Dpe” page on Master DB Editor

Vacuum Master DB Editor : vacmaster

File Utilities Refresh MV Help

DP Types & Dpe Attribute Types Control Types EQP Types LHC Types mapping Alarms EQP Types-Connections Connector Types PVSS Archives UNICOS Types

Data Types

Name	DataSize	LastUpdate
boolean	0	2005-10-06 13:2...
byte	1	2014-10-02 18:0...
dyn_bool	0	2010-12-10 07.4...
dyn_float	0	2011-08-26 08:2...
dyn_short	0	2012-02-15 12.0...
dyn_string	0	2007-03-01 17.4...
dyn_uint	0	2010-12-16 08.4...
float32	4	2005-03-24 10.5...
float64	8	2008-05-20 15.3...
integer16	2	2005-03-24 10.5...
integer32	4	2005-03-24 10.5...
string	0	2008-08-24 06.3...
string24Chars	24	2019-01-24 11.5...
uchar	1	2006-10-06 07.1...

DP Types

Name	Mobile ?	Master DP type	Address type	CCDB Class	LastUpdate
ALARM_DO	Fixed				2014-10-02 17:36:01.0
COLDEX	Fixed				2014-10-24 14:57:01.0
CRYO_VACOK	Fixed				2005-03-24 10:52:05.0
CRYO_VACOK_RO	Fixed				2005-03-24 10:52:05.0
EXP_AREA	Fixed				2007-04-11 08:40:49.0
V8DI_FE	Fixed				2014-01-29 17:26:57.0
VACCESS_ZONE	Fixed		CMW	PVSS_VAC_ACCESS	2009-09-10 08:44:50.0
VA_OK	Fixed				2015-09-22 15:26:30.0
VA_RI	Fixed			PVSS_VACUUM	2018-09-28 17:14:52.0
VBAKEOUT	Mobile in Sector				2007-03-01 16:20:09.0
VBEAM_Intens	Fixed				2008-08-27 10:47:56.0
VBEAM_PATH	Fixed				2009-02-04 09:07:49.0
VBGI_6B01	Fixed				2011-10-26 11:43:13.0
VBIC	Fixed		CMW		2010-12-16 08:48:24.0

DP Type(s) of Selected DP Type

Name	The Only D...	Data Type	ValueFormat	Write Data	PVSS DPE	SeqNo	Source DPE	Byte	Bit	No Address	Address Re...	Export	ExportName	ExportNam...	DP Func...	DpFunction	PLC Hea...	Updated
RR1	<input type="checkbox"/>	uinteger32		<input type="checkbox"/>	<input checked="" type="checkbox"/>	10				<input type="checkbox"/>		<input type="checkbox"/>					<input type="checkbox"/>	2014-01-2...
RR2	<input type="checkbox"/>	uinteger32		<input type="checkbox"/>	<input checked="" type="checkbox"/>	20				<input type="checkbox"/>		<input type="checkbox"/>					<input type="checkbox"/>	2014-01-2...
TS0.YMDH	<input type="checkbox"/>	uinteger32		<input type="checkbox"/>	<input checked="" type="checkbox"/>	30				<input type="checkbox"/>		<input type="checkbox"/>					<input type="checkbox"/>	2014-01-2...
TS0.MSM	<input type="checkbox"/>	uinteger32		<input type="checkbox"/>	<input checked="" type="checkbox"/>	40				<input type="checkbox"/>		<input type="checkbox"/>					<input type="checkbox"/>	2014-01-2...
TS1.YMDH	<input type="checkbox"/>	uinteger32		<input type="checkbox"/>	<input checked="" type="checkbox"/>	50				<input type="checkbox"/>		<input type="checkbox"/>					<input type="checkbox"/>	2014-01-2...
TS1.MSM	<input type="checkbox"/>	uinteger32		<input type="checkbox"/>	<input checked="" type="checkbox"/>	60				<input type="checkbox"/>		<input type="checkbox"/>					<input type="checkbox"/>	2014-01-2...
TS2.YMDH	<input type="checkbox"/>	uinteger32		<input type="checkbox"/>	<input checked="" type="checkbox"/>	70				<input type="checkbox"/>		<input type="checkbox"/>					<input type="checkbox"/>	2014-01-2...
TS2.MSM	<input type="checkbox"/>	uinteger32		<input type="checkbox"/>	<input checked="" type="checkbox"/>	80				<input type="checkbox"/>		<input type="checkbox"/>					<input type="checkbox"/>	2014-01-2...
TS3.YMDH	<input type="checkbox"/>	uinteger32		<input type="checkbox"/>	<input checked="" type="checkbox"/>	90				<input type="checkbox"/>		<input type="checkbox"/>					<input type="checkbox"/>	2014-01-2...
TS3.MSM	<input type="checkbox"/>	uinteger32		<input type="checkbox"/>	<input checked="" type="checkbox"/>	100				<input type="checkbox"/>		<input type="checkbox"/>					<input type="checkbox"/>	2014-01-2...
TS4.YMDH	<input type="checkbox"/>	uinteger32		<input type="checkbox"/>	<input checked="" type="checkbox"/>	110				<input type="checkbox"/>		<input type="checkbox"/>					<input type="checkbox"/>	2014-01-2...
TS4.MSM	<input type="checkbox"/>	uinteger32		<input type="checkbox"/>	<input checked="" type="checkbox"/>	120				<input type="checkbox"/>		<input type="checkbox"/>					<input type="checkbox"/>	2014-01-2...
TS5.YMDH	<input type="checkbox"/>	uinteger32		<input type="checkbox"/>	<input checked="" type="checkbox"/>	130				<input type="checkbox"/>		<input type="checkbox"/>					<input type="checkbox"/>	2014-01-2...
TS5.MSM	<input type="checkbox"/>	uinteger32		<input type="checkbox"/>	<input checked="" type="checkbox"/>	140				<input type="checkbox"/>		<input type="checkbox"/>					<input type="checkbox"/>	2014-01-2...
TS6.YMDH	<input type="checkbox"/>	uinteger32		<input type="checkbox"/>	<input checked="" type="checkbox"/>	150				<input type="checkbox"/>		<input type="checkbox"/>					<input type="checkbox"/>	2014-01-2...
TS6.MSM	<input type="checkbox"/>	uinteger32		<input type="checkbox"/>	<input checked="" type="checkbox"/>	160				<input type="checkbox"/>		<input type="checkbox"/>					<input type="checkbox"/>	2014-01-2...
TS7.YMDH	<input type="checkbox"/>	uinteger32		<input type="checkbox"/>	<input checked="" type="checkbox"/>	170				<input type="checkbox"/>		<input type="checkbox"/>					<input type="checkbox"/>	2014-01-2...
TS7.MSM	<input type="checkbox"/>	uinteger32		<input type="checkbox"/>	<input checked="" type="checkbox"/>	180				<input type="checkbox"/>		<input type="checkbox"/>					<input type="checkbox"/>	2014-01-2...
COMMENT	<input type="checkbox"/>	string		<input type="checkbox"/>	<input checked="" type="checkbox"/>	300			<input checked="" type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>					<input type="checkbox"/>	2014-01-2...
EqpStatus	<input type="checkbox"/>	uinteger16		<input type="checkbox"/>	<input checked="" type="checkbox"/>	310			<input checked="" type="checkbox"/>	<input type="checkbox"/>		<input checked="" type="checkbox"/>					<input type="checkbox"/>	2015-04-1...
WR1	<input type="checkbox"/>	uinteger16		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	10				<input type="checkbox"/>		<input type="checkbox"/>					<input type="checkbox"/>	2014-01-2...

row 6 | Modified:false | Editing : VoDpType

Projects – Master DB Editor Web

- “DP Types & Dpe” page on Master DB Editor Web

The screenshot displays the Master DB Editor Web interface. On the left is a dark sidebar with navigation options: Home, DP Types, Control Types, EQP Types, LHC Types Mapping, Alarms, EQP Types Conne..., Connector Types, PVSS Archives, and UNICOS Types. The main content area is divided into three sections:

- Data Types:** A table with columns Name, Data Size, and Last Update. It lists types like byte, boolean, dyn_bool, dyn_float, and dyn_short.
- Data Point Types:** A table with columns Name, Mobile?, Master DP Type, Address Type, CCDB Class, and Last Update. It lists types like ALARM_DO, COLDEX, CRYO_VACOK, CRYO_VACOK_RO, and EXP_AREA.
- DPE(s) of selected DP Types:** A detailed table with columns Name, The Only DPE, Data Type, Value Format, Write Data, PVSS DPE, Seq Number, Source DPE, Byte, Bit, No Address, Address Reference, Export, Export Name, Export Name 2, DP Func. Src., DP Function, PLC Health, and Last Update. It lists DPEs like RR1, OBJECTST, DEV1OBJECTST, DEV1PHYVAL, and DEV2OBJECTST.

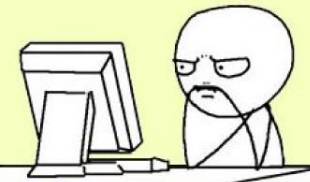
Each table includes a pagination control (Total items, page numbers, 5/page, Goto) and action buttons (+ New, Delete, Edit, Download). The top right corner shows a user profile icon and the text "Log out (jofranci)".

Experience/Personal Development

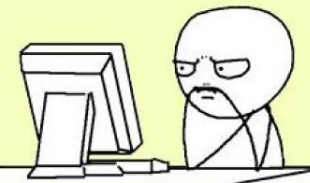
- New technologies
 - Java Frameworks (Spring Boot)
 - Continuous Integration – Automatic deployment to test and production
 - Deployment (openshift, docker containers)
 - Front-End Frameworks (ReactJS)
 - WinCC-OA
- New methodologies
 - Project Planning (Project Management Professional Guidelines)
 - Agile Methodologies (Scrum)

PROGRAMMERS WHILE CODING

IT DOESN'T WORK.....WHY?



IT WORK.....WHY?



Training Courses

- Spring & Hibernate for Beginners (May 22, 2019)
- Full Stack Project: Spring Boot 2.0, ReactJS, Redux (June 6, 2019)
- Just enrolled on French Course



Future Work

- Complete Master DB Editor Renovation
- New Diagnostic tools for vacuum SCADA
 - SMS notifications feature
 - Vacuum monitoring room diagnostics enhancement
- vacDM enhancements and refactor into a Micro-Services architecture

Milestone	Expected Completion Date
Project Planning	August 2019
Analysis of Legacy Master DB Editor	August 2019
Software Development	February 2020
Testing	March 2020
Documentation	May 2020

