

sonata

agile service development and orchestration in 5G virtualized networks

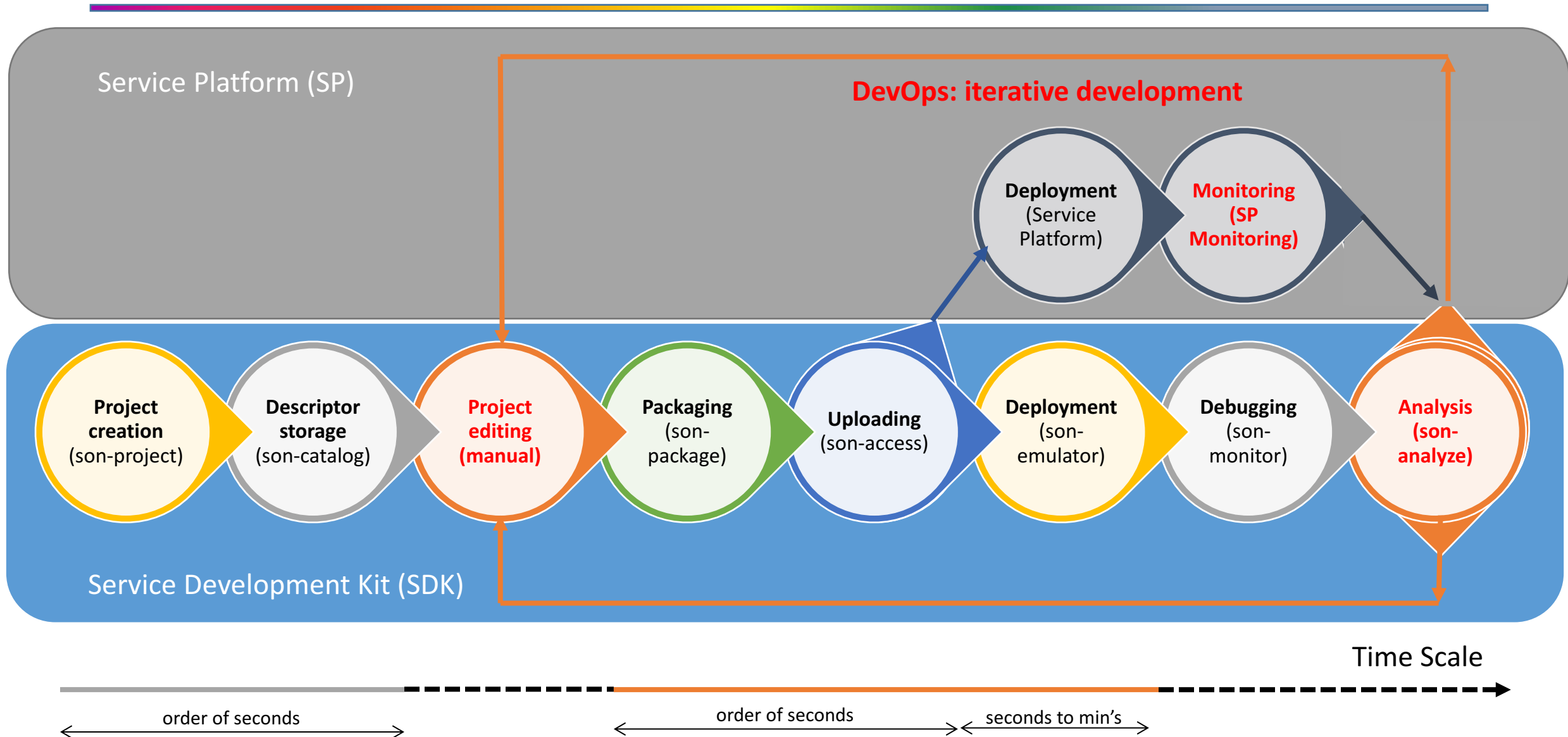


NS development and deployment workflows

George Xilouris ([NCSR Demokritos](#))

SDN NFV WORLD CONGRESS 2017, 9-13 Oct. 2017, The Hague

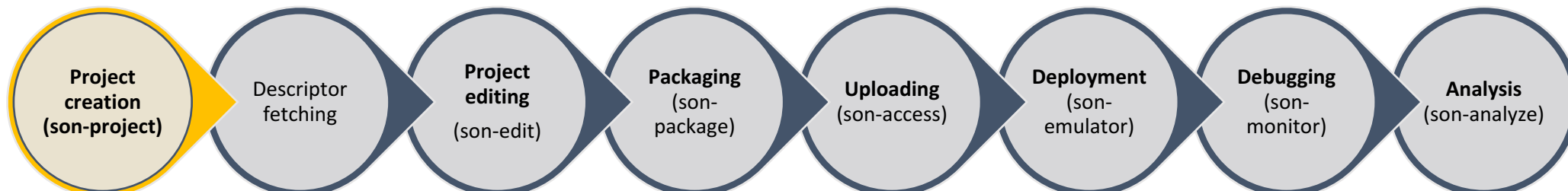
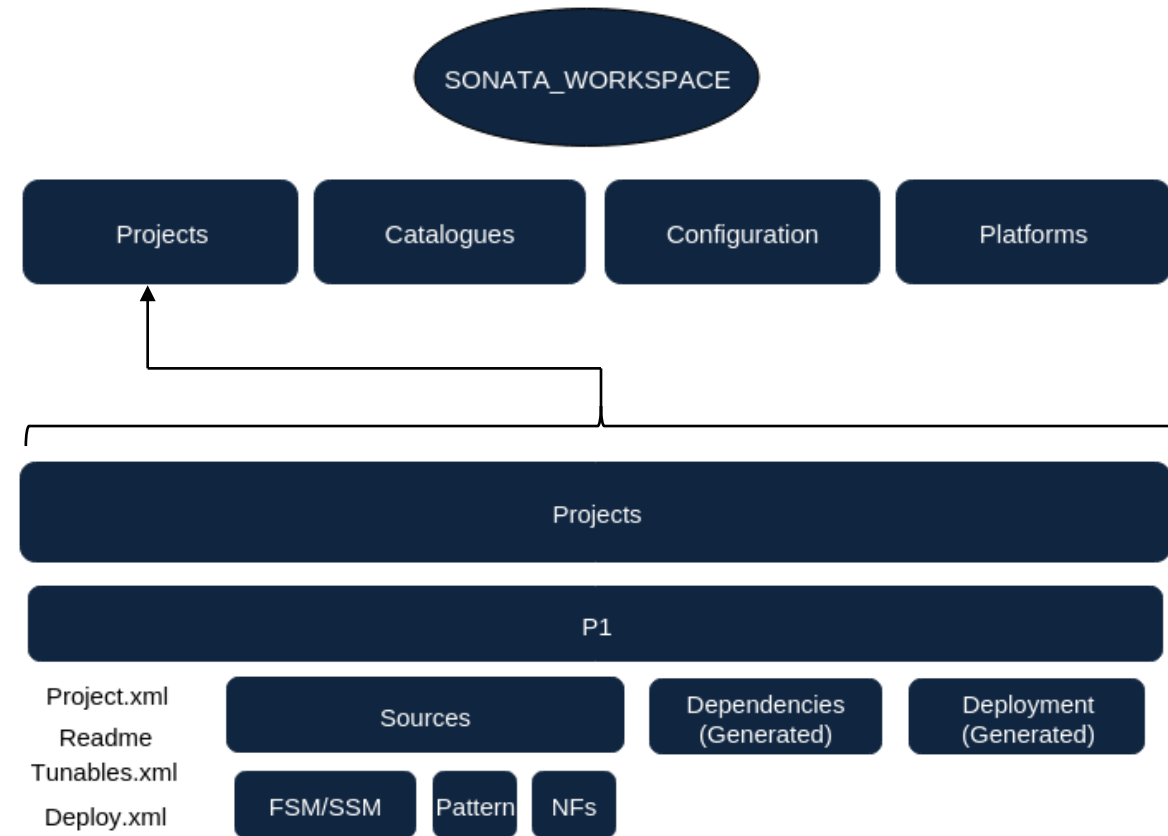
Service Development Workflow



Project creation – *son-workspace/son-project*

- Create workspace
- Keep developer **custom configurations**
 - catalogue repository addresses
 - schema repository location
- Create projects
 - Instantiate base service **project skeleton**
 - Creation of **sample** service and function

Enables interaction with packaging functionality, catalogues and SP



```
a622328@a622328:~$ git clone https://github.com/sonata-nfv/son-examples.git
Cloning into 'son-examples'...
remote: Counting objects: 5971, done.
remote: Compressing objects: 100% (6/6), done.
remote: Total 5971 (delta 0), reused 3 (delta 0), pack-reused 5965
Receiving objects: 100% (5971/5971), 30.24 MiB | 39.00 KiB/s, done.
Resolving deltas: 100% (2705/2705), done.
Checking connectivity... done.
a622328@a622328:~$ █
```

```
$ son-workspace --init --workspace test_ws --debug
```

I

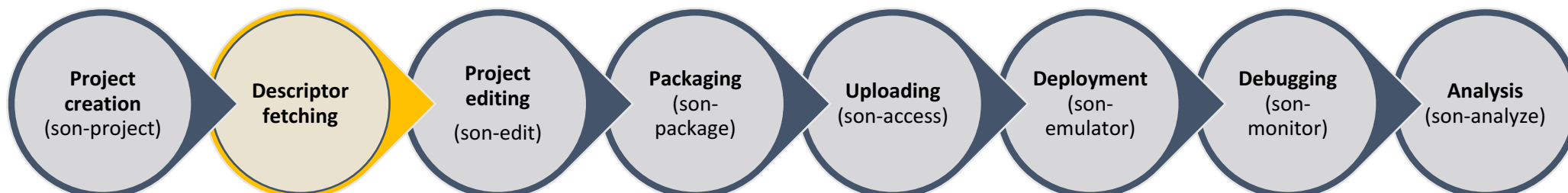
Step1 – cloning the SONATA examples repository and creating the workspace |

Descriptor fetching – *from GitHub, etc.*

- Developer's **local storage** for network service & NF descriptor needs.
- Availability of valid existing network service and virtual network function descriptors to facilitate network service development
- Access/connectivity to 3rd party / **public websites or catalogues.**

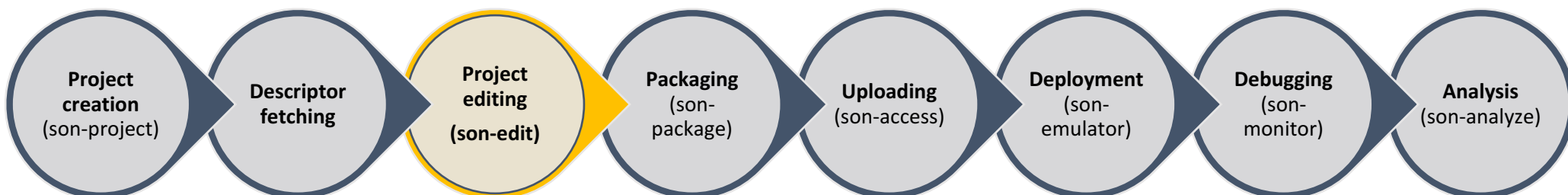
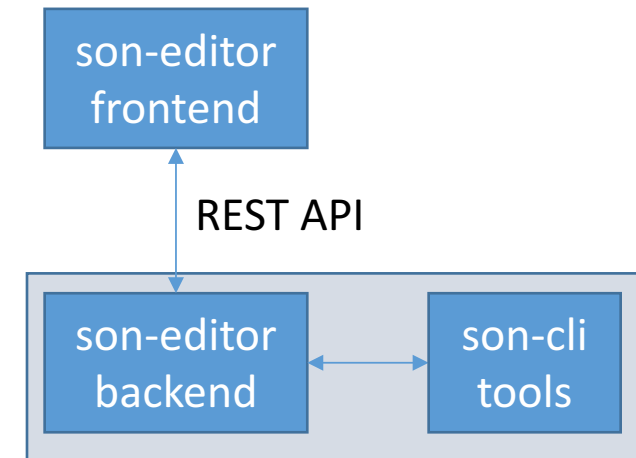
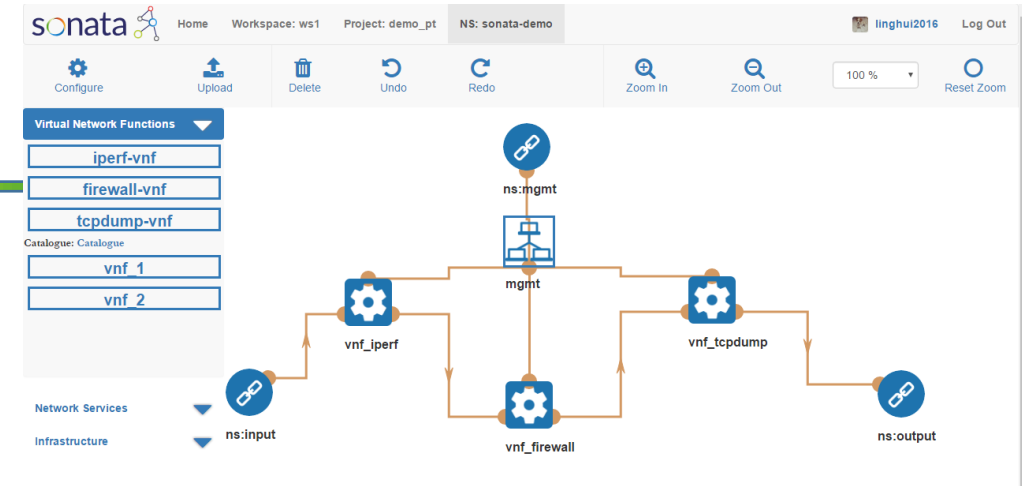


```
1 ##
2 ## This is the network service descriptor of the
3 ## SONATA demo example that comprises a virtual traffic
4 ## classifier (vTC)
5 ##
6 ## @author Felipe Vicens
7 ##
8 ---
9 descriptor_version: "1.0"
10
11 vendor: "eu.sonata-nfv.service-descriptor"
12 name: "sonata-demo-1"
13 version: "0.1"
14 author: "Felipe Vicens, Atos IT Solutions and Services Iberia"
15 description: >
16   "The network service descriptor for the SONATA demo,
17   comprising a Virtual Traffic Classifier"
18
```

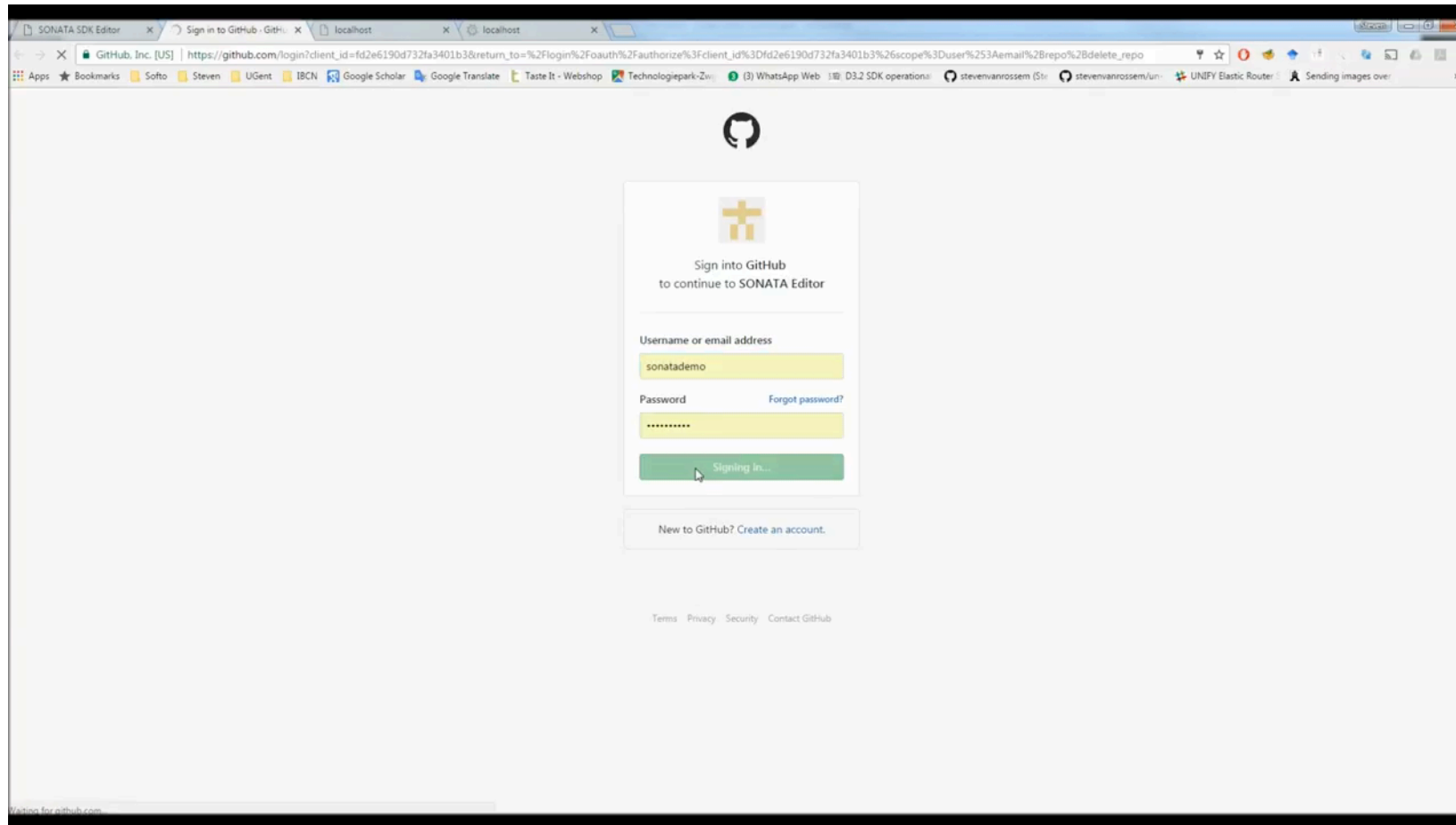


Project editing - son-editor

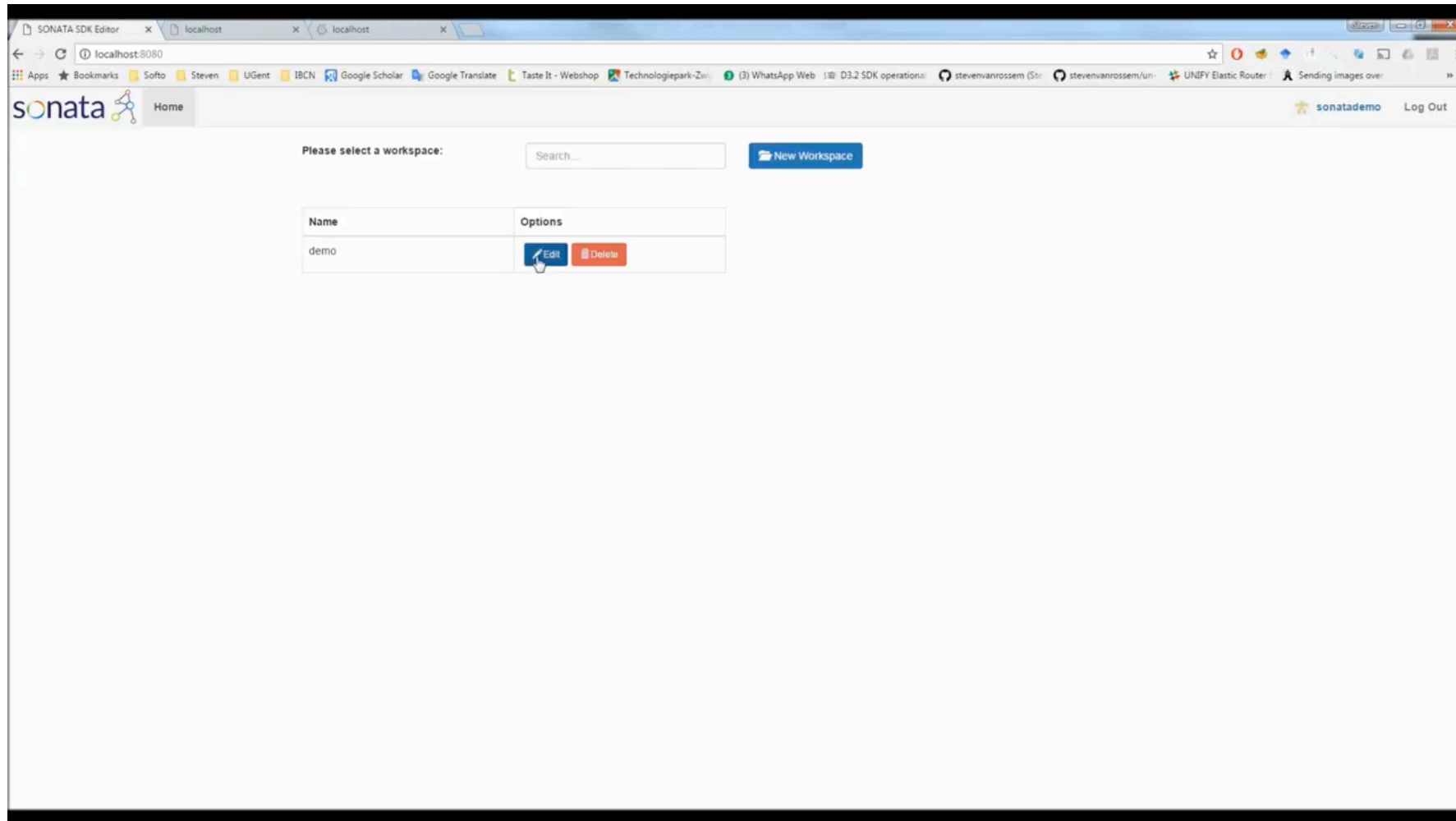
- **Graphical tool** and editor of service and NF descriptors
- **Web-based** technology consisting of front-end and back-end part communicating via REST API
- Supports **interaction with GitHub** for fetching existing projects & descriptors
- **son-validate**: validates the syntax of the resulting descriptors



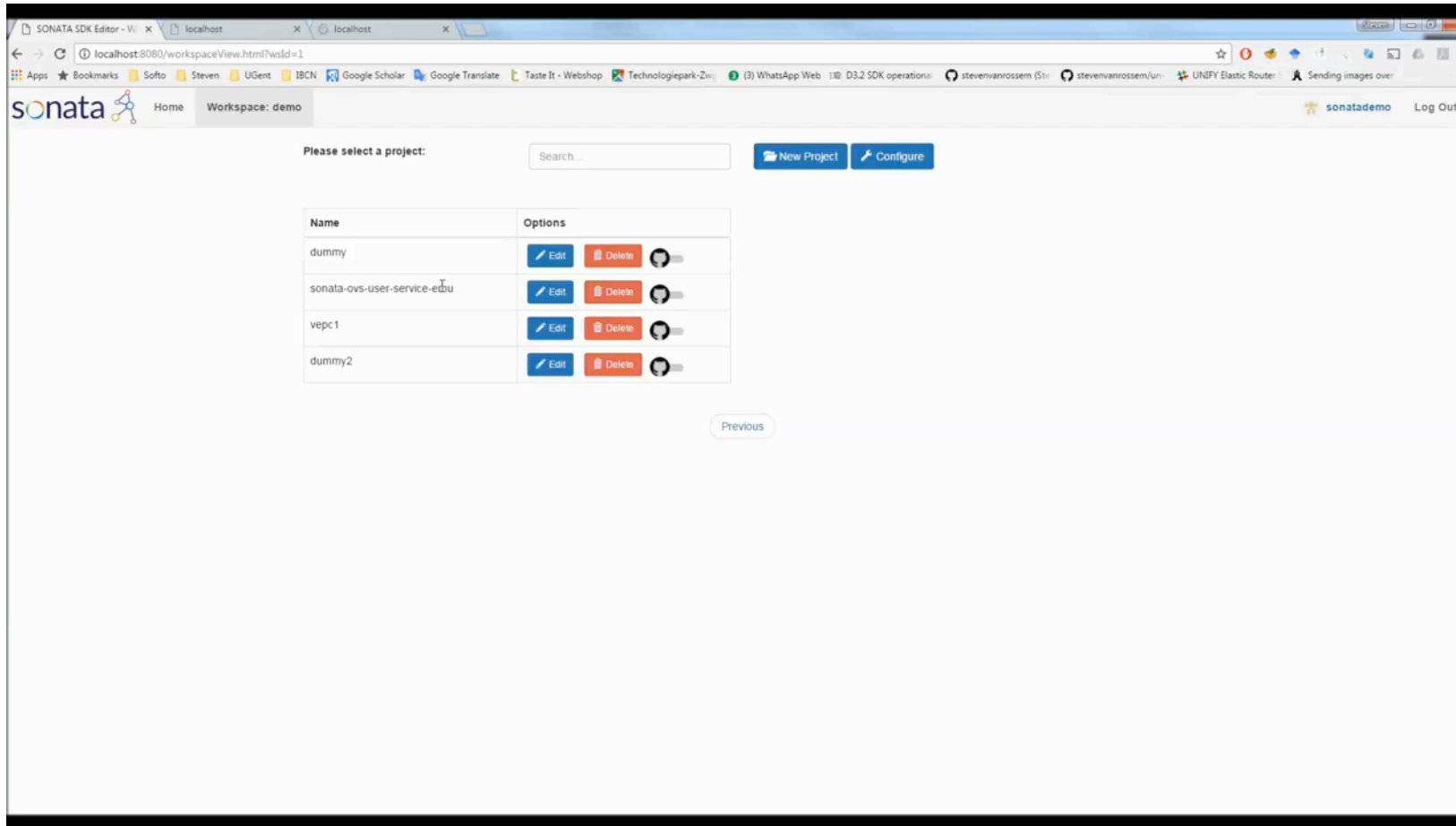
Step 3 – Invoking SONATA NS Editor



Step 3a – Workspace selection



Step 3b – Project list

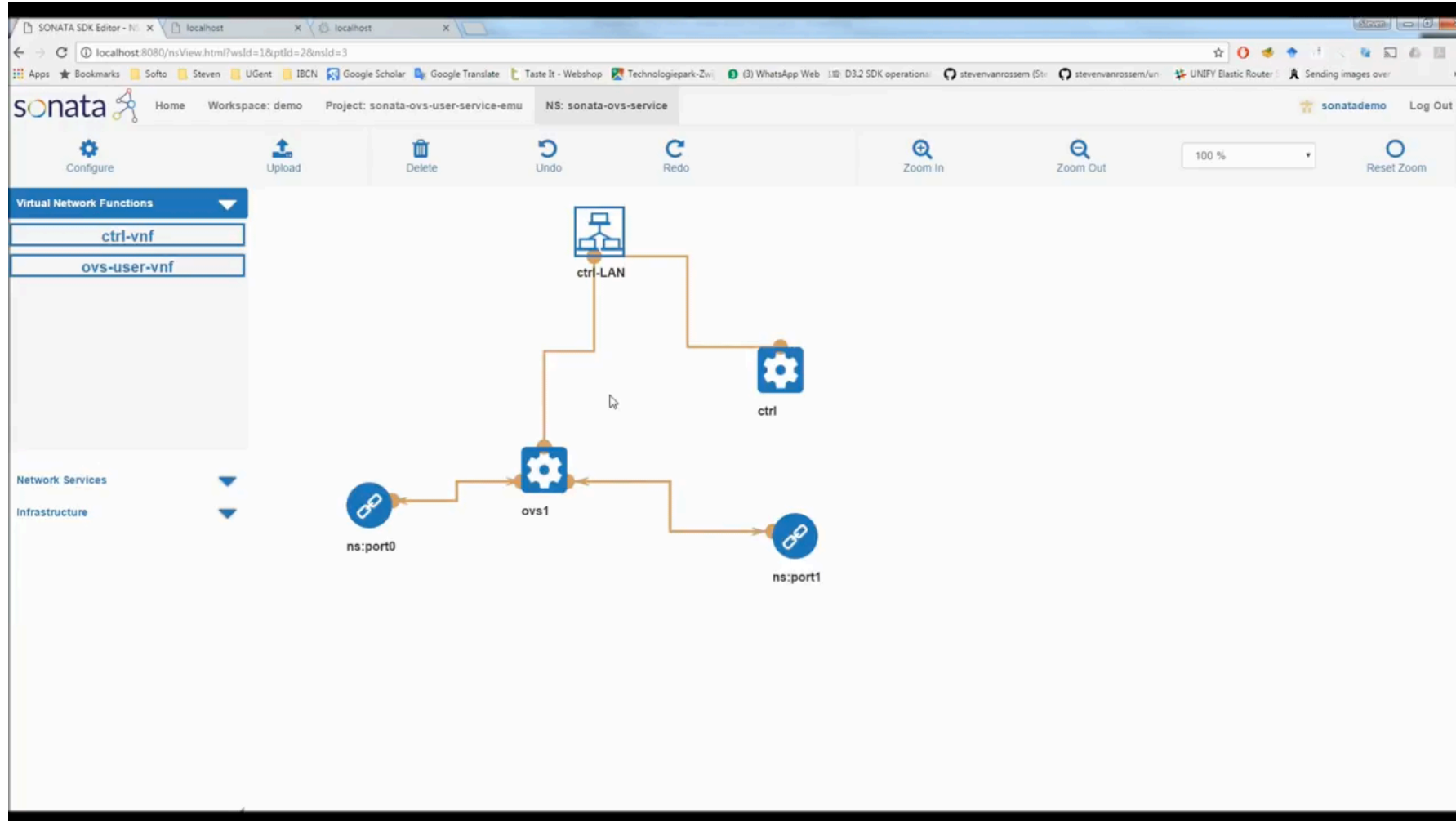


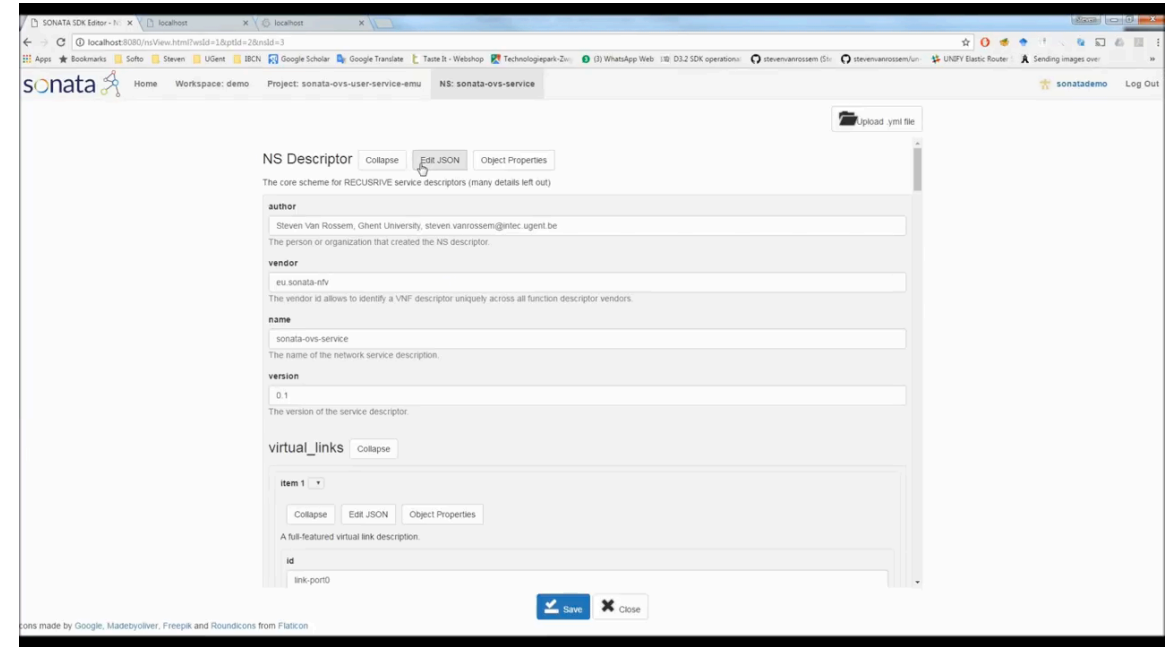
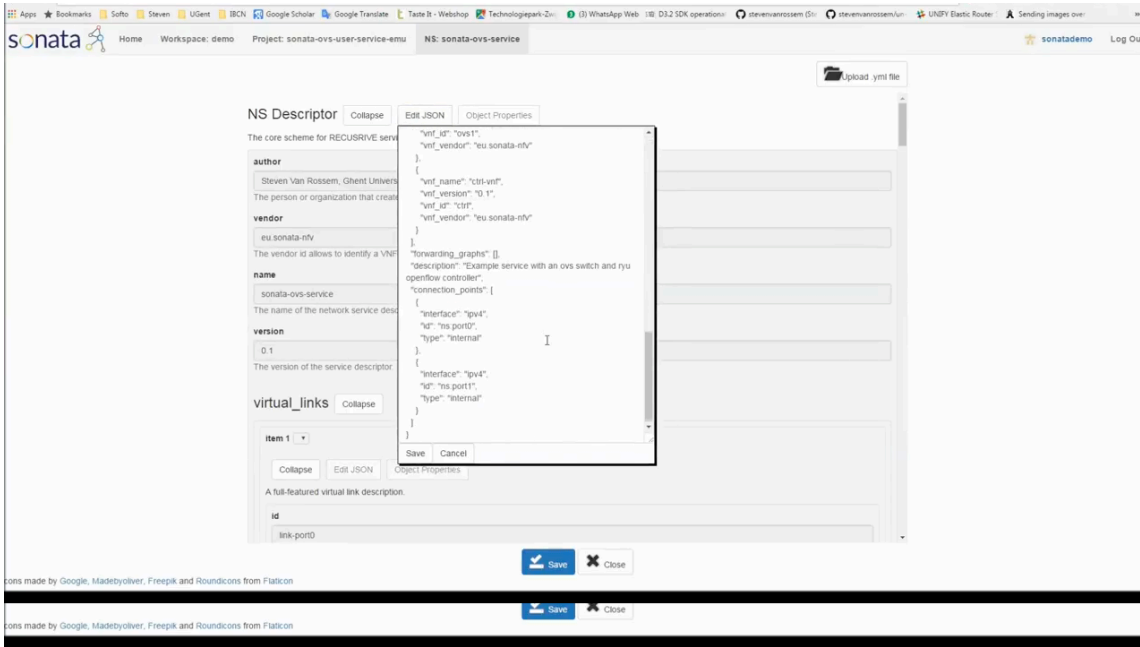
The screenshot shows the SONATA SDK Editor interface in a web browser. The browser's address bar displays `localhost:8080/workspaceView.html?wsId=1`. The page header includes the SONATA logo, navigation links for 'Home' and 'Workspace: demo', and a 'Log Out' button. Below the header, a section titled 'Please select a project:' contains a search input field and two buttons: 'New Project' and 'Configure'. A table lists the available projects, each with 'Edit', 'Delete', and status toggle options.

Name	Options
dummy	Edit Delete
sonata-oys-user-service-edu	Edit Delete
vepc1	Edit Delete
dummy2	Edit Delete

Below the table, there is a 'Previous' button.

Step 3c – Visual Editor





Step 3d – Overview of descriptors

```
a622328@a622328:~/repo/son-examples/service-projects$ son-validate --workspace test_ws --project sonata-fw-vtc-service-sp
2017-10-09 23:03:24 a622328 son.workspace.project[27906] INFO Loading Project configuration 'sonata-fw-vtc-service-sp/project.yml'
2017-10-09 23:03:24 a622328 son.validate.validate[27906] INFO Validating project 'sonata-fw-vtc-service-sp'
2017-10-09 23:03:24 a622328 son.validate.validate[27906] INFO ... syntax: True, integrity: True, topology: True
2017-10-09 23:03:24 a622328 son.validate.validate[27906] INFO Validating service 'sonata-fw-vtc-service-sp/sources/nsd/sonata-demo.yml'
2017-10-09 23:03:24 a622328 son.validate.validate[27906] INFO ... syntax: True, integrity: True, topology: True
2017-10-09 23:03:24 a622328 son.validate.validate[27906] INFO Validating syntax of service 'eu.sonata-nfv.service-descriptor.sonata-demo-1.0.2'
2017-10-09 23:03:24 a622328 son.validate.validate[27906] INFO Validating integrity of service 'eu.sonata-nfv.service-descriptor.sonata-demo-1.0.2'
2017-10-09 23:03:24 a622328 son.validate.validate[27906] INFO Validating function 'sonata-fw-vtc-service-sp/sources/vnf/fw-vnf/fw-vnf-vnfd.yml'
2017-10-09 23:03:24 a622328 son.validate.validate[27906] INFO ... syntax: True, integrity: True, topology: True
2017-10-09 23:03:24 a622328 son.validate.validate[27906] INFO Validating syntax of function 'eu.sonata-nfv.fw-vnf.0.2'
2017-10-09 23:03:24 a622328 son.validate.validate[27906] INFO Validating integrity of function descriptor 'eu.sonata-nfv.fw-vnf.0.2'
2017-10-09 23:03:24 a622328 son.validate.validate[27906] INFO Validating topology of function 'eu.sonata-nfv.fw-vnf.0.2'
2017-10-09 23:03:24 a622328 son.validate.validate[27906] INFO Validating function 'sonata-fw-vtc-service-sp/sources/vnf/vtc-vnf/vtc-vnf-vnfd.yml'
2017-10-09 23:03:24 a622328 son.validate.validate[27906] INFO ... syntax: True, integrity: True, topology: True
2017-10-09 23:03:24 a622328 son.validate.validate[27906] INFO Validating syntax of function 'eu.sonata-nfv.vtc-vnf.0.1'
2017-10-09 23:03:24 a622328 son.validate.validate[27906] INFO Validating integrity of function descriptor 'eu.sonata-nfv.vtc-vnf.0.1'
2017-10-09 23:03:24 a622328 son.validate.validate[27906] INFO Validating topology of function 'eu.sonata-nfv.vtc-vnf.0.1'
2017-10-09 23:03:24 a622328 son.validate.validate[27906] INFO Validating topology of service 'eu.sonata-nfv.service-descriptor.sonata-demo-1.0.2'
==== Statistics: 0 error(s) and 0 warning(s) ====
Errors: []
Warnings: []
a622328@a622328:~/repo/son-examples/service-projects$
```

```
son-validate --workspace test_ws --project sonata-fw-vtc-service-sp
```

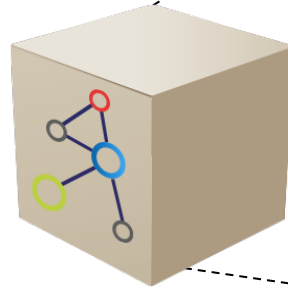
Step 3e – Syntax validation

Packaging – concept

- Packages are the **primary artifact** in the SONATA ecosystem
 - Created using the SDK
 - Shipped to catalogs and the SONATA Service Platform

- SONATA supports slim and fat packages

- A **slim** package contains references to artifacts
- A **fat** package contains all the artifacts

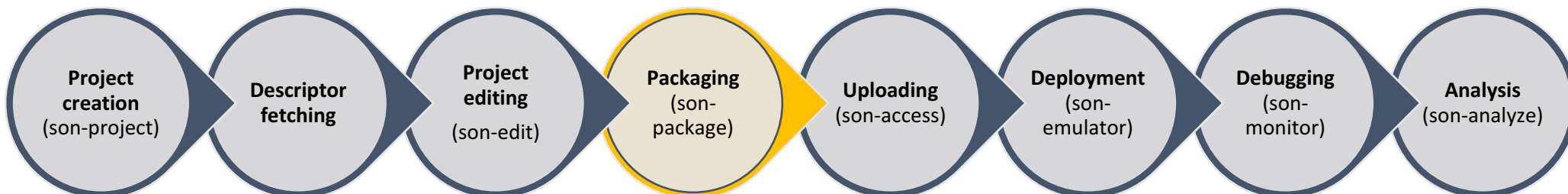


```
--- Package Descriptor (Manifest.MF)
descriptor_version: "1.0"

vendor: "eu.sonata-nfv.service-descriptor"
name: "sonata-demo"
version: "0.2.1"

[...]

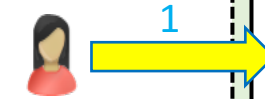
package_content:
  - name: "/service_descriptors/sonata-demo.yml"
    content-type:
      "application/sonata.service_descriptor"
      md5: "0bb347f5bcd4986fccfc44ee87932c48"
  [...]
```



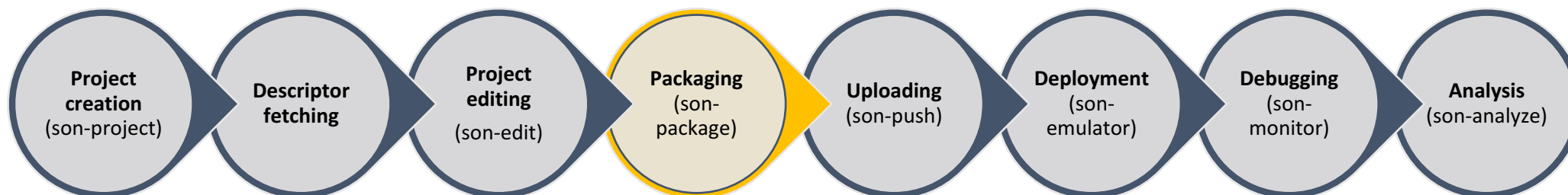
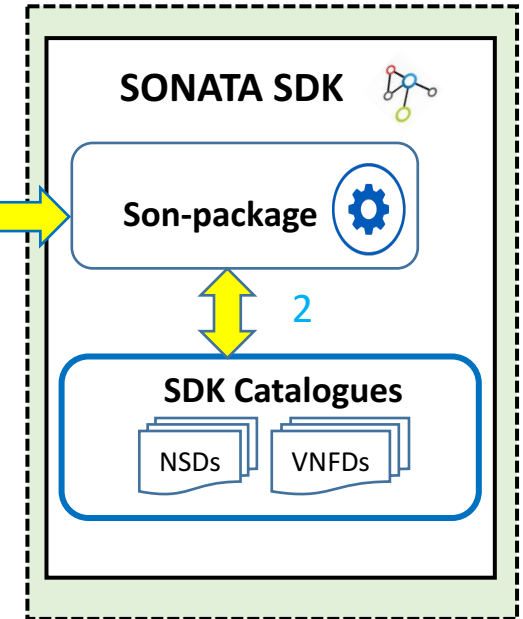
Packaging – *son-package* functionality

- **Packaging** of project into a single file
- Solves external project **dependencies**
- **Retrieval of remote project descriptors** from SDK catalogues
- **Syntax validation** of descriptors against the latest schema definitions
- Generation of a MANIFEST/MD5 hash

1. Developer executes create package



2. Son-package retrieves required NSD/VNFD from the SDK catalogues.

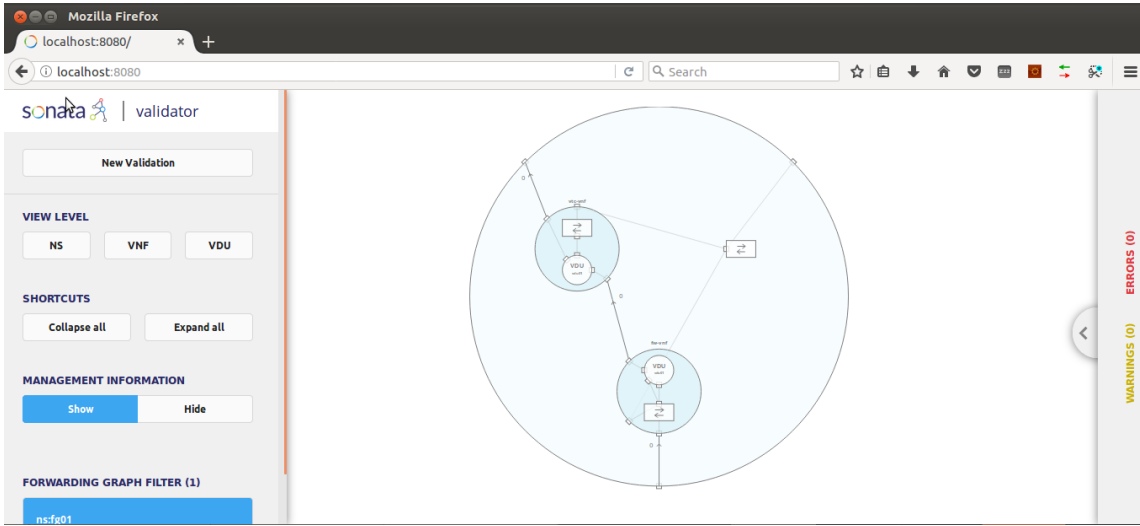



```

2017-10-09 23:16:49 a622328 son.workspace.project[28112] INFO Loading Project configuration 'sonata-fw-vtc-service-sp' in sonata-fw-vtc-service-sp
2017-10-09 23:16:49 a622328 requests.packages.urllib3.connectionpool[28112] INFO Starting new HTTP connection (1): sp.int3.sonata-nfv.eu
2017-10-09 23:16:50 a622328 requests.packages.urllib3.connectionpool[28112] DEBUG "GET /api/v2/micro-services/public-key HTTP/1.1" 200 457
2017-10-09 23:16:50 a622328 son.package.package[28112] INFO Create Package Content Section
2017-10-09 23:16:50 a622328 son.package.package[28112] DEBUG Validating Service Descriptor NSD='sonata-demo.yml'
2017-10-09 23:16:51 a622328 son.validate.validate[28112] INFO Validating service 'sonata-fw-vtc-service-sp/sources/nsd/sonata-demo.yml'
2017-10-09 23:16:51 a622328 son.validate.validate[28112] INFO ... syntax: True, integrity: False, topology: False
2017-10-09 23:16:51 a622328 son.validate.validate[28112] INFO Validating syntax of service 'eu.sonata-nfv.service-descriptor.sonata-demo-1.0.2'
2017-10-09 23:16:51 a622328 son.schema.validator[28112] DEBUG Loading previously stored schema for NSD
2017-10-09 23:16:51 a622328 son.package.package[28112] INFO Packaging VNF descriptors from project source...
2017-10-09 23:16:51 a622328 son.package.package[28112] DEBUG Validating VNF descriptor file='fw-vnf/fw-vnf-vnfd.yml'
2017-10-09 23:16:51 a622328 son.validate.validate[28112] INFO Validating function 'sonata-fw-vtc-service-sp/sources/vnf/fw-vnf/fw-vnf-vnfd.yml'
2017-10-09 23:16:51 a622328 son.validate.validate[28112] INFO ... syntax: True, integrity: False, topology: False
2017-10-09 23:16:51 a622328 son.validate.validate[28112] INFO Validating syntax of function 'eu.sonata-nfv.fw-vnf.0.2'
2017-10-09 23:16:51 a622328 son.schema.validator[28112] DEBUG Loading previously stored schema for VNFD
2017-10-09 23:16:51 a622328 son.package.package[28112] DEBUG Validating VNF descriptor file='vtc-vnf/vtc-vnf-vnfd.yml'
2017-10-09 23:16:51 a622328 son.validate.validate[28112] INFO Validating function 'sonata-fw-vtc-service-sp/sources/vnf/vtc-vnf/vtc-vnf-vnfd.yml'
2017-10-09 23:16:51 a622328 son.validate.validate[28112] INFO ... syntax: True, integrity: False, topology: False
2017-10-09 23:16:51 a622328 son.validate.validate[28112] INFO Validating syntax of function 'eu.sonata-nfv.vtc-vnf.0.1'
2017-10-09 23:16:51 a622328 son.schema.validator[28112] DEBUG Loading previously stored schema for VNFD
2017-10-09 23:16:51 a622328 son.package.package[28112] INFO package_pcs executed in 0.397 sec
2017-10-09 23:16:51 a622328 son.package.package[28112] INFO Create Package Resolver Section
2017-10-09 23:16:51 a622328 son.package.package[28112] DEBUG There are no required Package Resolvers. This section will not be included.
2017-10-09 23:16:51 a622328 son.package.package[28112] INFO package_prs executed in 0.000 sec
2017-10-09 23:16:51 a622328 son.package.package[28112] INFO Create Package Dependencies Section
2017-10-09 23:16:51 a622328 son.package.package[28112] DEBUG There are no required Package Dependencies. This section will not be included.
2017-10-09 23:16:51 a622328 son.package.package[28112] INFO package_pds executed in 0.001 sec
2017-10-09 23:16:51 a622328 son.package.package[28112] INFO Create Artifact Dependencies Section
2017-10-09 23:16:51 a622328 son.package.package[28112] DEBUG There are no required Artifact Dependencies. This section will not be included.
2017-10-09 23:16:51 a622328 son.package.package[28112] INFO package_ads executed in 0.000 sec
2017-10-09 23:16:51 a622328 son.package.package[28112] INFO Create General Description section
2017-10-09 23:16:51 a622328 son.package.package[28112] INFO package_gds executed in 0.000 sec
2017-10-09 23:16:51 a622328 son.package.package[28112] DEBUG Validating Package

```

Step 4a: Creating the package



The screenshot shows the Sonata Validator web application with the 'New Validation' dialog box open. The dialog has the following fields and options:

- NEW VALIDATION:** A section with two dropdown menus: 'TYPE' set to 'PACKAGE' and 'SOURCE' set to 'EMBEDDED'.
- VALIDATIONS:** Three checkboxes: 'Syntax' (checked), 'Integrity' (checked), and 'Topology' (checked).
- PATH:** A text input field.
- FILE UPLOAD:** A 'Browse...' button and the text 'No file selected.'

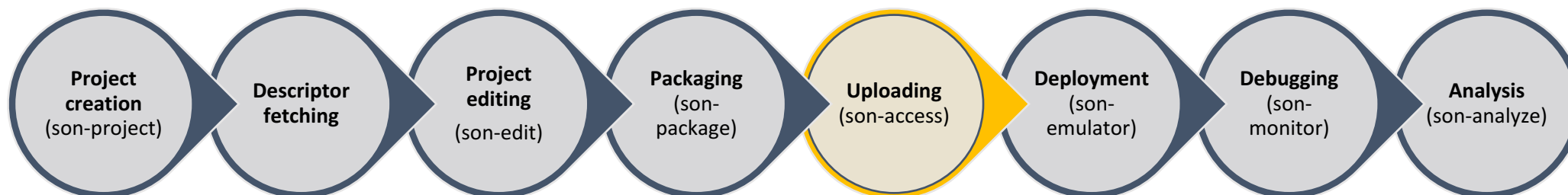
The background shows the same network diagram as the previous screenshot, with 'ERRORS (0)' and 'WARNINGS (0)' indicators on the right.

Step 4b: Package validation

Uploading – *son-access*

- **Uniform SDK interface** to either the Service Platform's Gatekeeper or the SDK emulator (emulated Service Platform)
- **Upload service packages** to Gatekeeper
- Obtain list of **available packages** from Gatekeeper
- View the list of **instantiated services**

Can be extended to support any Service Platform (using REST api)



- Authenticate to the SP
- Push the package `son-access push --upload sonata-fw-vtc-service-sp.son`

[illegible]

Step 6a - Select the service at the son-BSS

SonataBSS Available Network Services Requests Network Services Instances Licence Store

sonata | Logout



Available Network Services

Name	Description	Vendor	Version	Service Id	Licence Type	Actions
sonata-demo- vtc	"The network service descriptor for the SONATA demo, comprising only a Virtual Traffic Classifier"	eu.sonata- nfv.service-descriptor	0.1	c7bbbed59- cbe5-43f6-8cc9-98415ba173ac	Public	
sonata-demo- private-vtc	"The network service descriptor for the SONATA demo, comprising only a Virtual Traffic Classifier. This service is defined as private (licence is required)"	eu.sonata- nfv.service-descriptor	0.1	42212c00-fda7-4ac4- bebd-0000777891aa	To Buy	
sonata-demo-1	"The network service descriptor for the SONATA demo, comprising a Virtual Traffic Classifier"	eu.sonata- nfv.service-descriptor	0.2	14d81f44-3ae1-4241- adf6-8978c403d3c6	Public	

Step 6b – Service Instantiation

SonataBSS

Available Network Services

Requests

Network Services Instances

Licence Store

sonata | Logout

Instantiate sonata-demo-1 Network Service

Ingress

Location

-- Location --

Network Attachment Point (NAP)

Enter Network Attachment Point

Add New Ingress

Egress

Location

-- Location --

Network Attachment Point (NAP)

Enter Network Attachment Point

Add New Egress

Please, confirm the Service instantiation:

Yes

No

Available Network Services

Name	Description
sonata-demo-vc	"The network service descriptor for the Traffic Classifier"
sonata-demo-private-vc	"The network service descriptor for the Traffic Classifier. This service is defined as private (licence is required)"
sonata-demo-1	"The network service descriptor for the Traffic Classifier"

ubuntu®

default • sonata.dem

sonata.dem

Project

Compute

Network

Orchestration

Stacks

Resource Types

Admin

Identity

Stacks / SonataService-3c34f7f4-3321-4fc9-96f6-66f2d518a68f

Check Stack

Topology

Overview

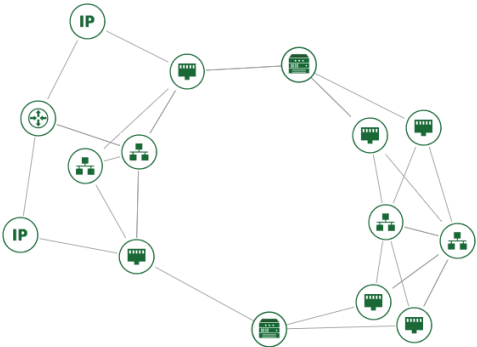
Resources

Events

Template

SonataService-3c34f7f4-3321-4fc9-96f6-66f2d518a68f

Update Complete



SonataBSS

Available Network Services

Requests

Network Services Instances

Licence Store

sonata | Logout

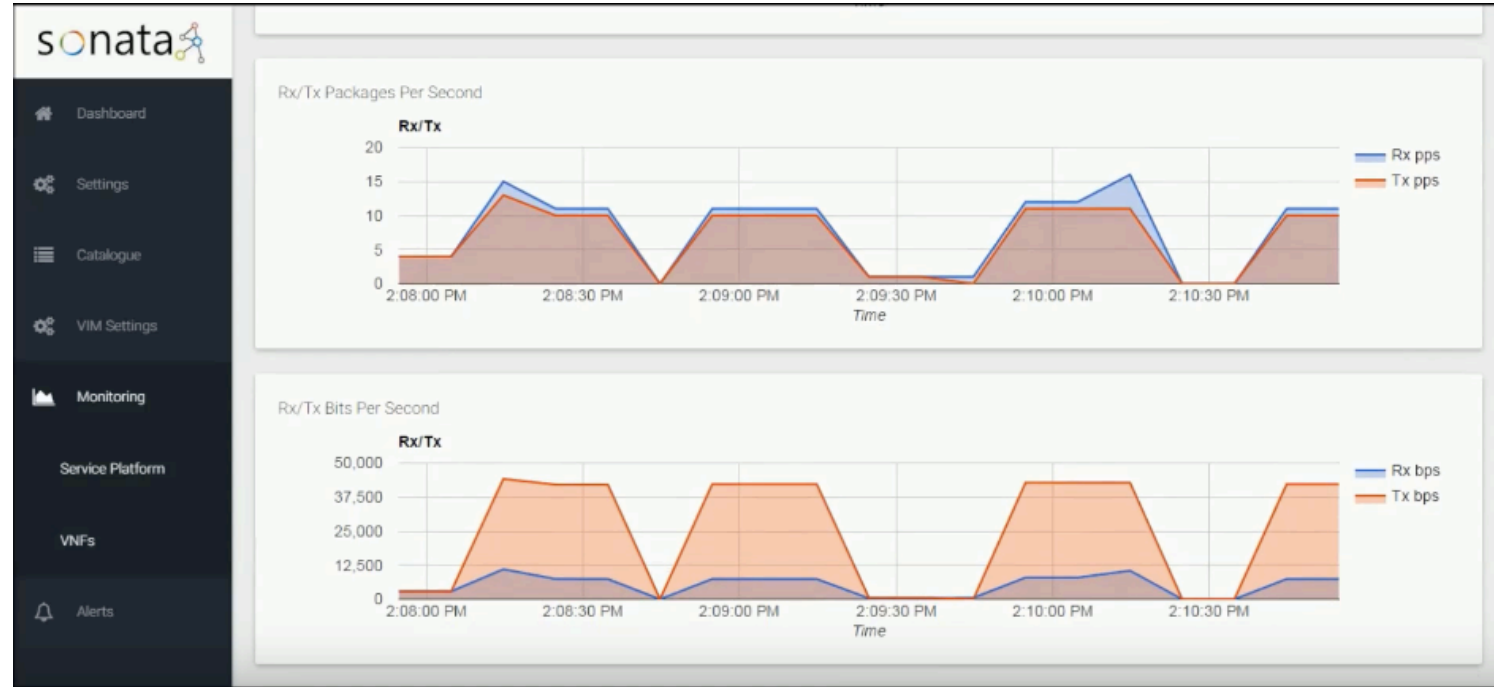
sonata



Search Requests

Requests

Step 7 – Service Running

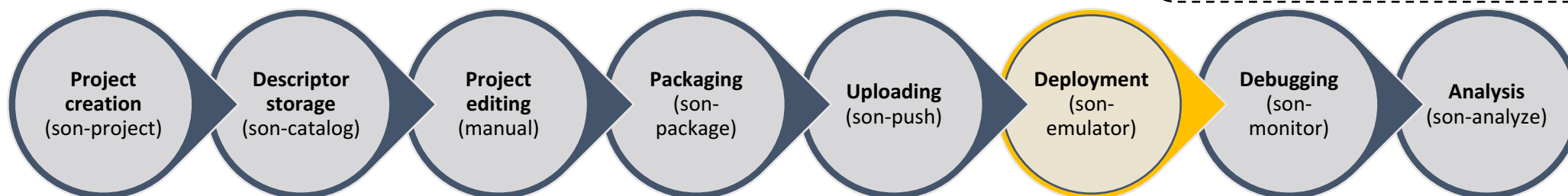
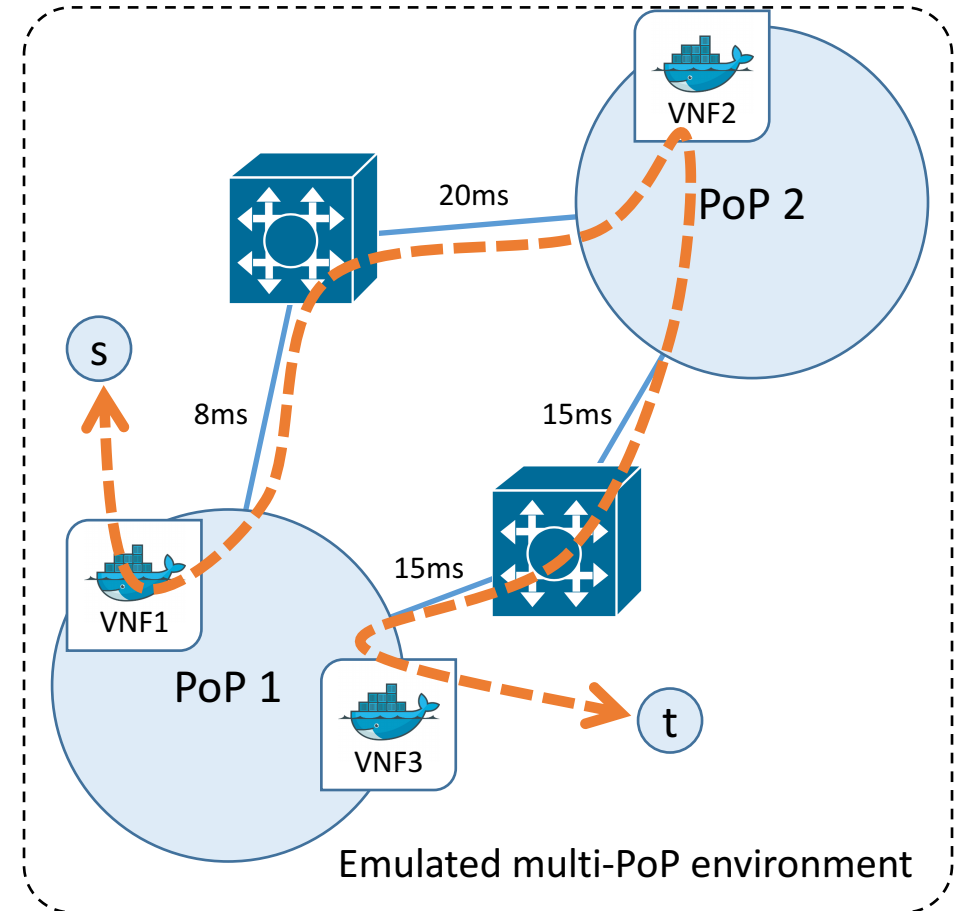


Step 8 – Service Monitoring

Alternative path towards the SONATA emulator

Deployment – *son-emu* features

- Interactive, cloud-like **rapid prototyping** platform
- Executed on **developer's laptop**
- **Production-ready** network services
- Executes **container-based** VNFs
- Custom **multi-PoP** topologies
- **Service Chaining** support
- **MANO** system **integration**
- Integrates with **SONATA workflow** and tools



Step alt5 package on-boarding to emulator

SONATA SDK Editor - Emulator Dashboard - localhost

localhost:5001/dashboard/index.html

Apps ★ Bookmarks Softo Steven UGent IBCN Google Scholar Google Translate Taste It - Webshop Technologiepark-Zw (3) WhatsApp Web D3.2 SDK operation stevenvanrossem (Str stevenvanrossem/Un UNIFY Elastic Router Sending images over

Emulated Datacenters 2

Latency: -

Label	Int. Name	Switch	Num. Containers	VNFs
dc21	dc2	dc2.s1	3	ovs1,ns_port1,ns_port0
dc11	dc1	dc1.s1	1	ctrl

Running Containers 4

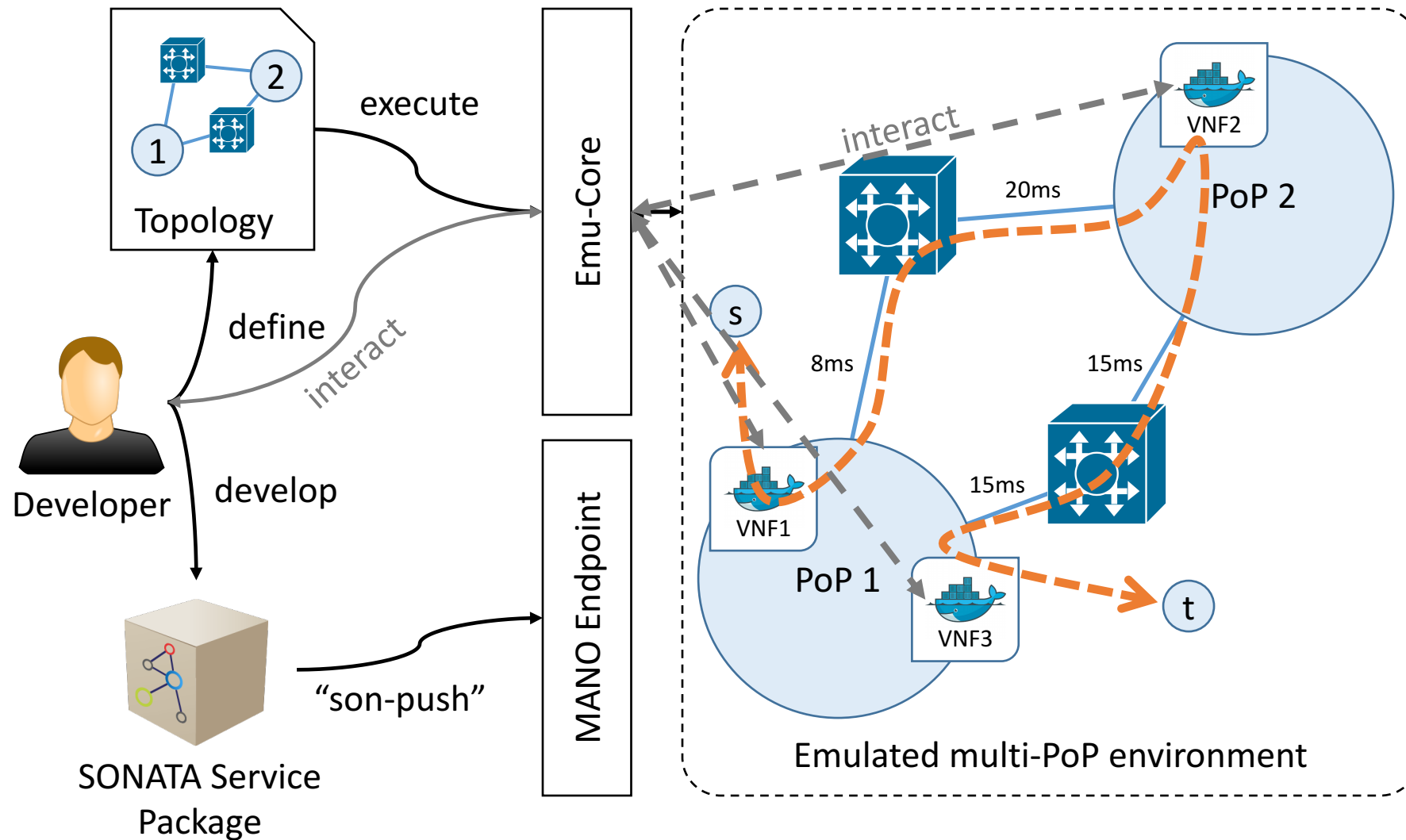
Latency: -

Datacenter	Container	Image	docker0	--Networking-- datacenter port	interface	ip	mac
dc2	ovs1	sonatanfv/sonata-ovs-user-vnf	172.17.0.4	dc2.s1-eth2 dc2.s1-eth3 dc2.s1-eth4	ctrl-port port0 port1	10.20.0.1/24 10.30.1.1/30 10.30.3.1/30	8e:91:0e:6f:30:98 d6:fb:a5:03:17:a4 9a:77:28:58:8e:d4
dc2	ns_port1	sonatanfv/son-emu-sap	172.17.0.6	dc2.s1-eth5	port1	10.30.3.2/30	fa:b4:84:e7:6e:07
dc2	ns_port0	sonatanfv/son-emu-sap	172.17.0.7	dc2.s1-eth6	port0	10.30.1.2/30	be:6f:5d:7d:70:bb
dc1	ctrl	sonatanfv/sonata-ryu-vnf	172.17.0.5	dc1.s1-eth2	ctrl-port	10.20.0.2/24	2e:a5:9f:43:99:9a

Placement Graph

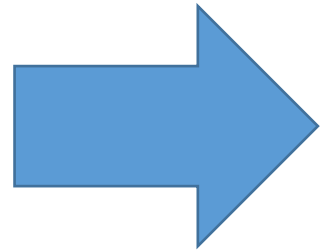
```
graph TD
    ns_port0 --- ns_port1
    ns_port1 --- dc1.s1
    ns_port1 --- dc2.s1
    dc1.s1 --- ctrl
    dc1.s1 --- ovs1
    dc1.s1 --- s1
    ovs1 --- s1
```

Deployment – son-emu usage workflow

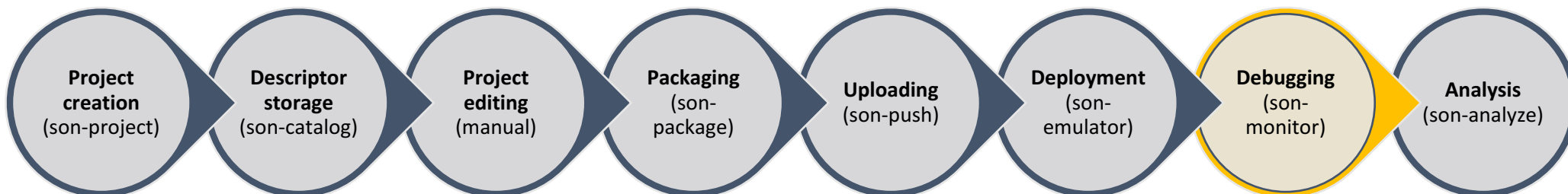


Debugging – SDK *son-monitor* objectives

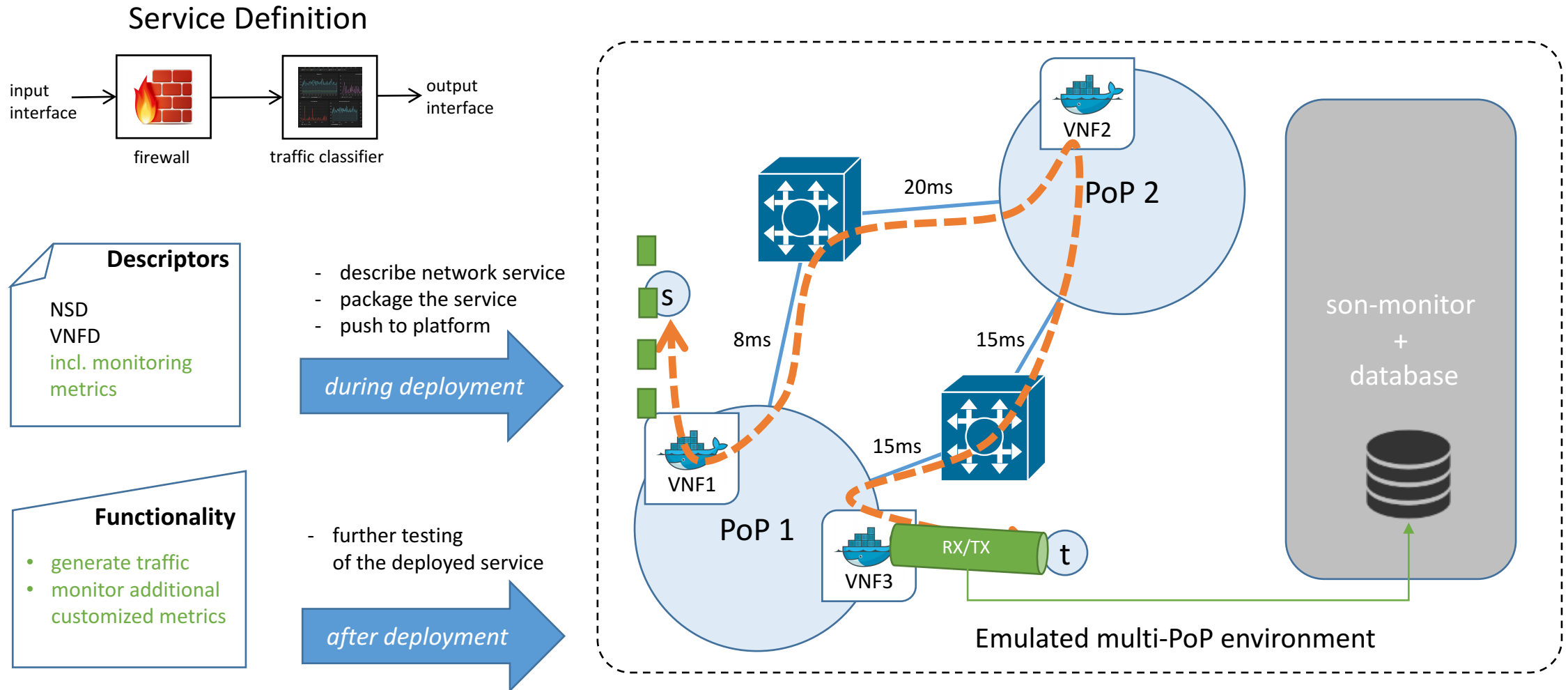
- Newly developed service might contain **bugs**
 - Functionality bugs (not working as intended)
 - Performance bugs
- Newly **developed service might be not well understood**



- son-monitor = range of **debugging and profiling** features to investigate
- Enable a more **efficient development and deployment workflow** for a network service.
- Provide a **dataset of metrics** that further analysis (e.g., workload prediction, scaling thresholds). Metrics might be pre-processed (aggregated, etc.)

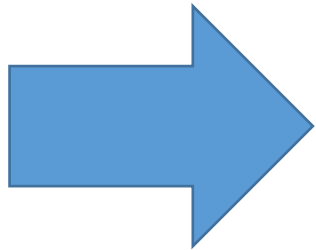


Debugging – SDK *son-monitor* flow

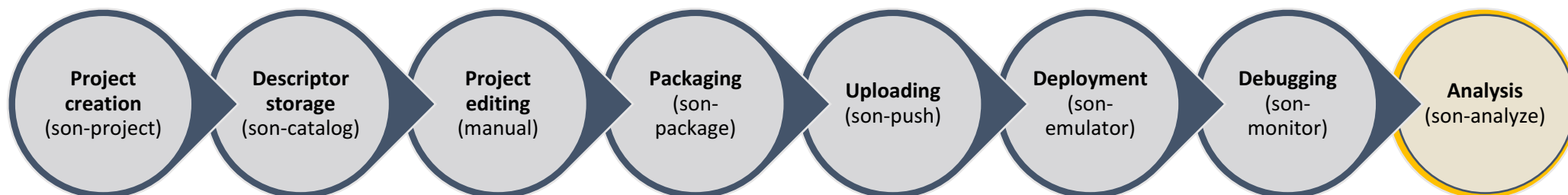


Analysis - *son-analyze* motivation & concept

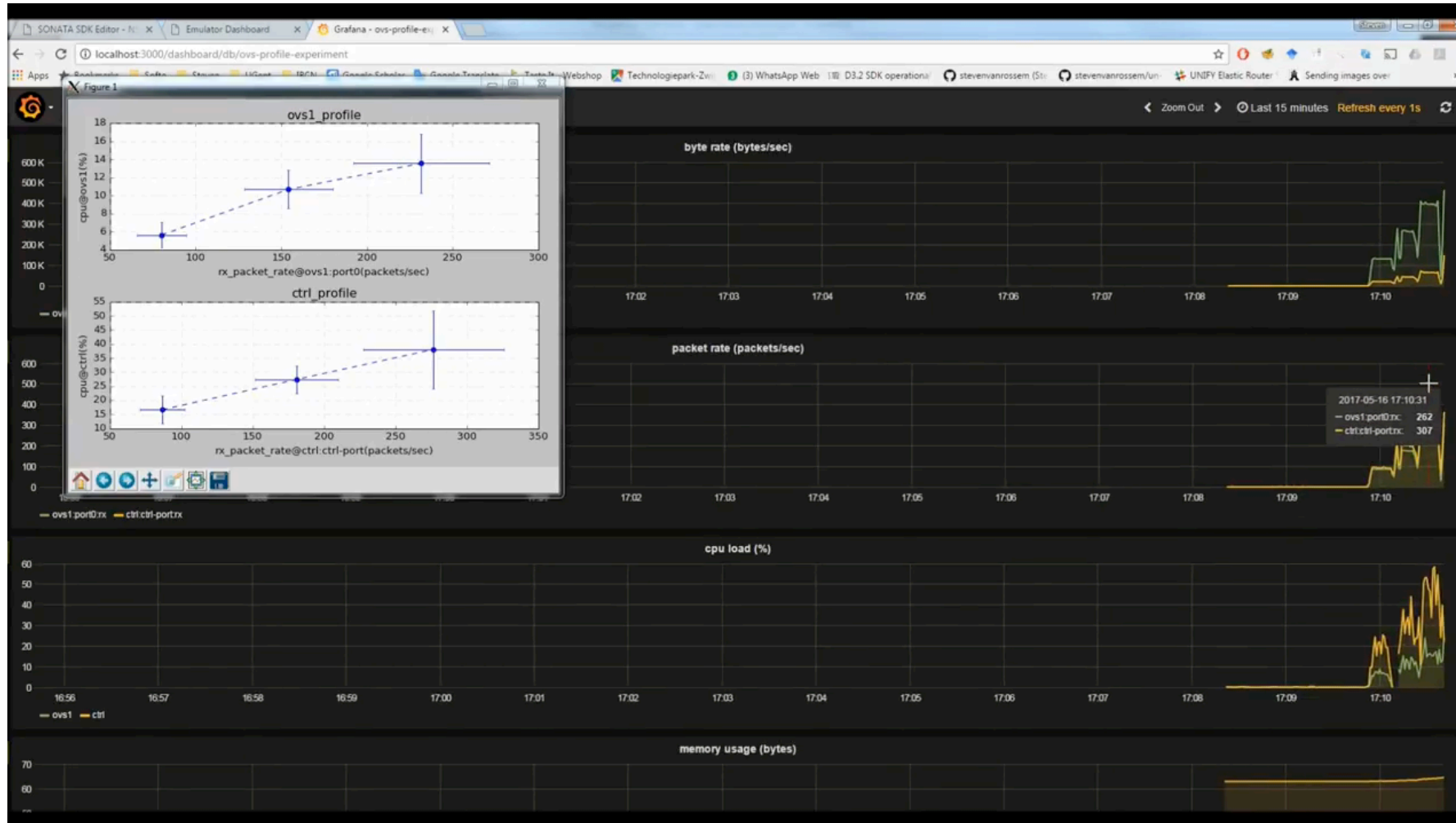
- Services are **continuously changing** in DevOps fashion
- **New actors** may wish to enter the network world
- How to **analyze a dynamic, software-based environment** ?
 - Workload prediction
 - SLA violation



- Development framework for building **custom analysis over services**
- **Interactive User Interface** with graph capabilities
- **Integrates** with the SONATA SP and the SONATA SDK
- **High-level structures** around services' metrics



Alt step 6 – profiling and analysis



Conclusions

- One of the **first open-source**, vendor-independent SDK for NFV
- **SDK emulator environment** enabling developers to **rapidly validate and deploy** the developed service in multi-PoP setting on a limited local environment (e.g., laptop)
- **Working prototype, open-source code base** with clear **roadmap** available
- **Effective integration operations with service development (DevOps)** for 5G

sonata

agile service development and orchestration in 5G virtualized networks



Thank you!

Start at <http://sonata-nfv.github.io>

Check the full demo video at <https://www.youtube.com/watch?v=KaowDCSTzcM&t=77s>

GitHub

