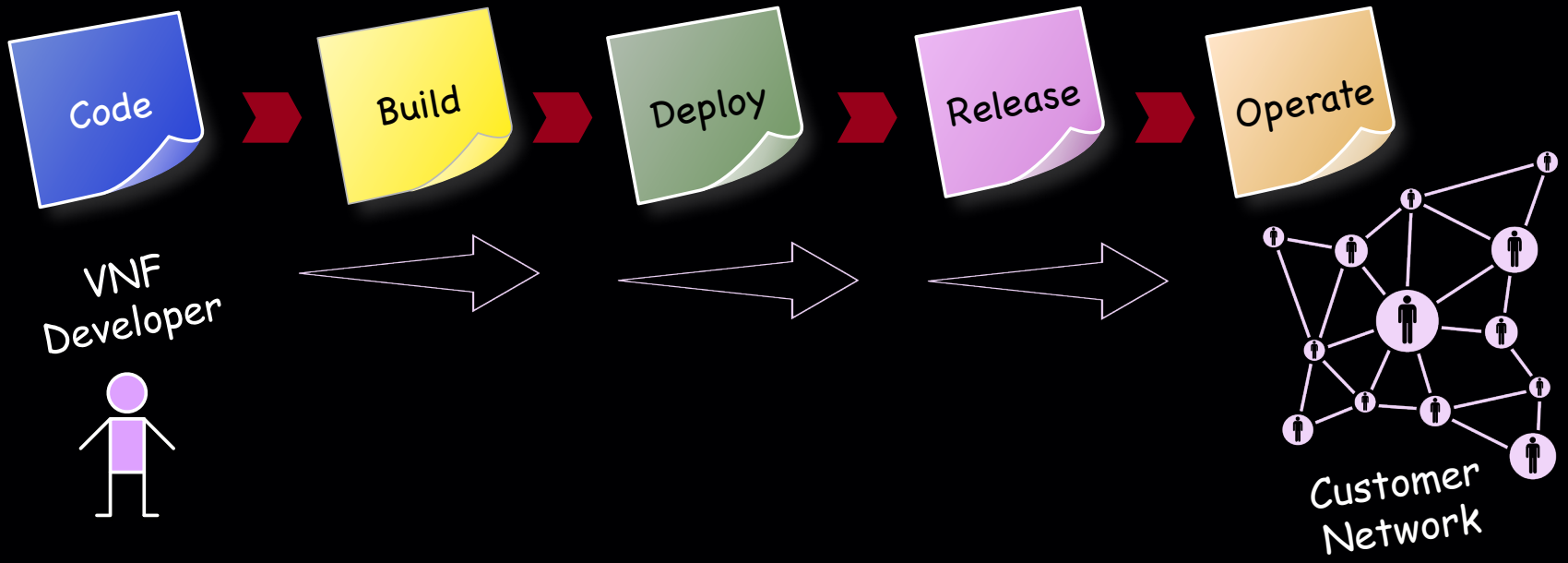
NOKIA Bell Labs

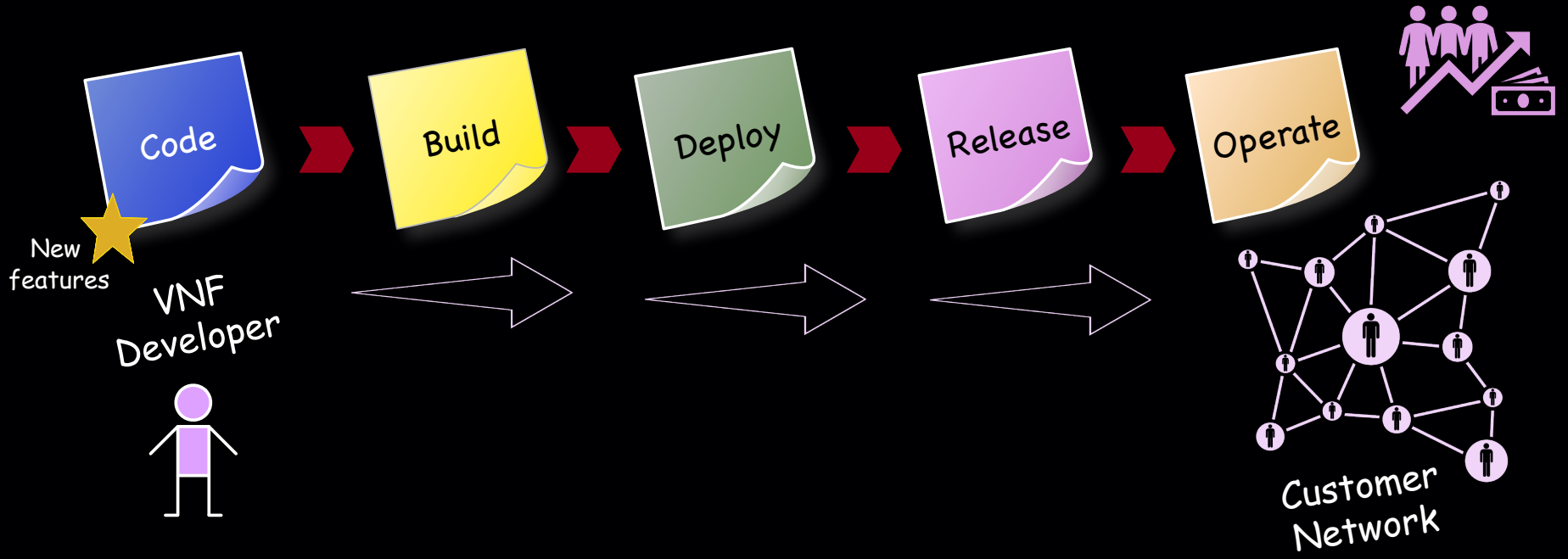
Env2Vec

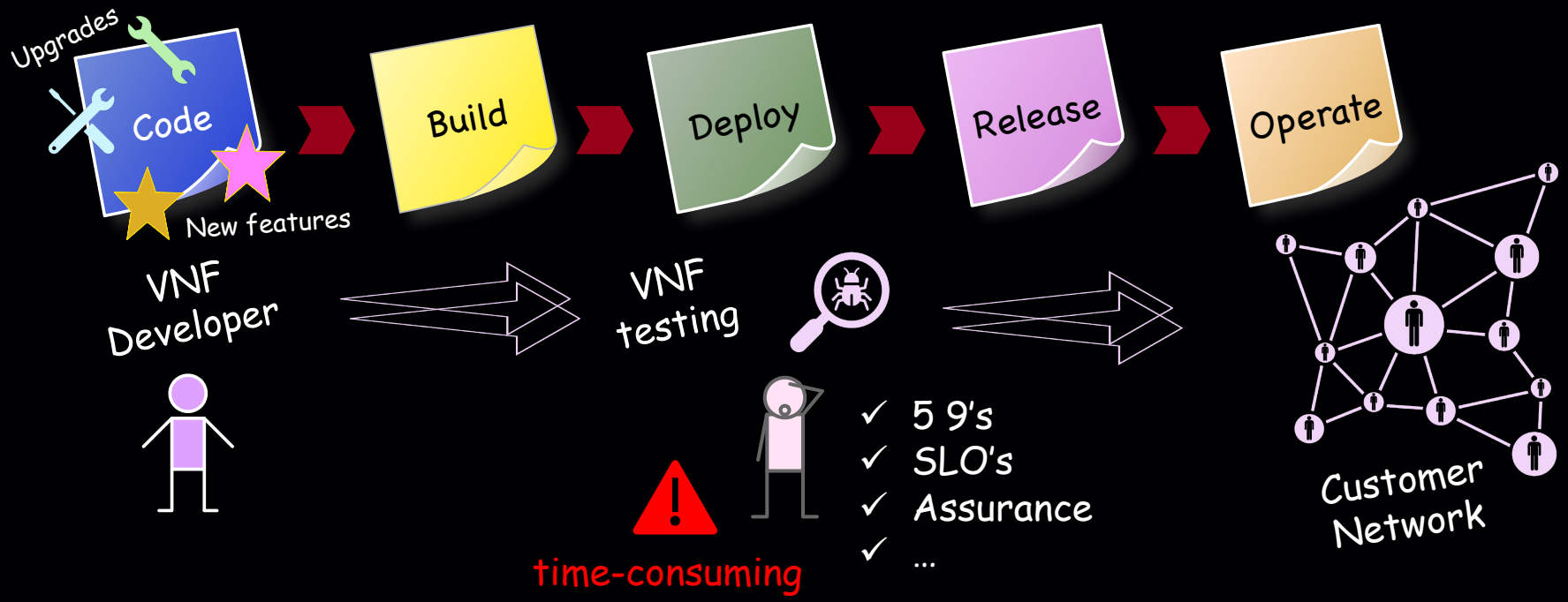
Accelerating VNF Testing with Deep Learning

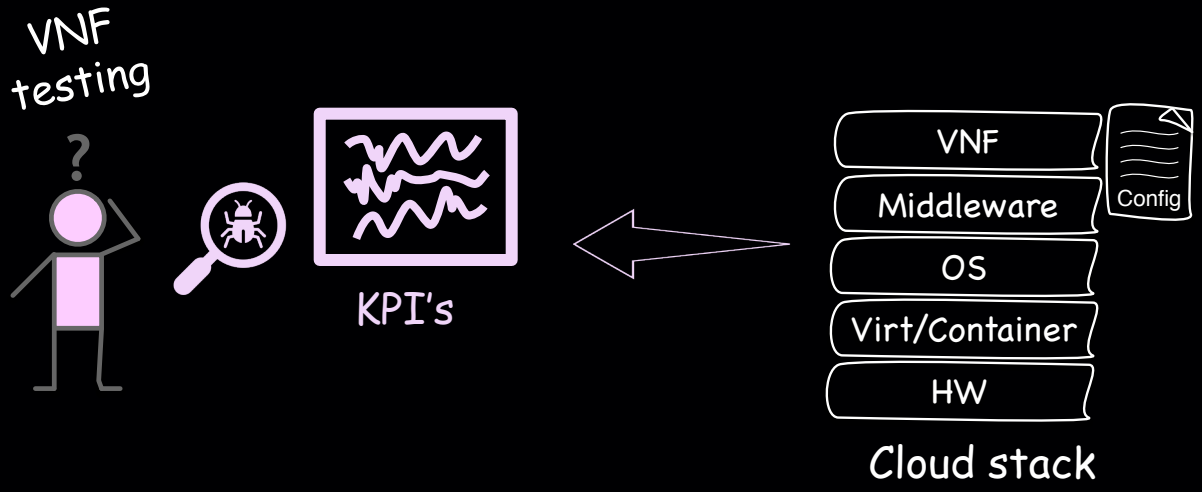
Guangyuan Piao, Pat Nicholson, Diego Lugones

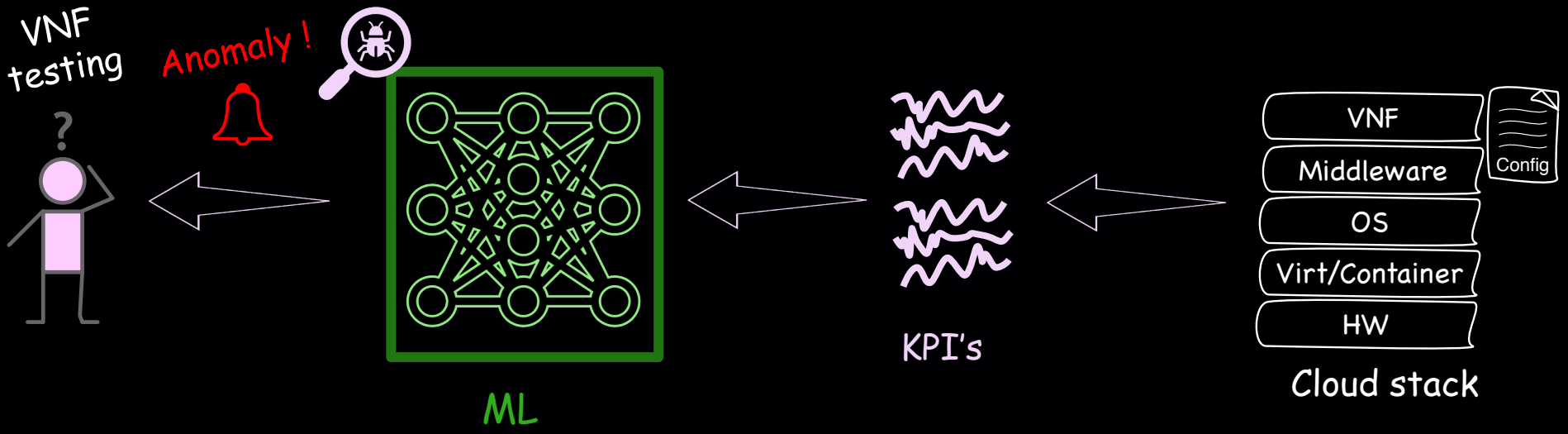
Eurosys 2020


Code
Build
Deploy
Release
Operate
VNF Developer
Customer Network


Code
Build
Deploy
Release
Operate
New features
VNF Developer
Customer Network


Upgrades
Code
New features
Build
Deploy
Release
Operate
VNF Developer
VNF testing
time-consuming
✓ 5 9's
✓ SLO's
✓ Assurance
✓ ...
Customer Network


VNF
testing
?
KPI's
VNF
Middleware
OS
Virt/Container
HW
Config
Cloud stack


VNF testing
?
Anomaly !
ML
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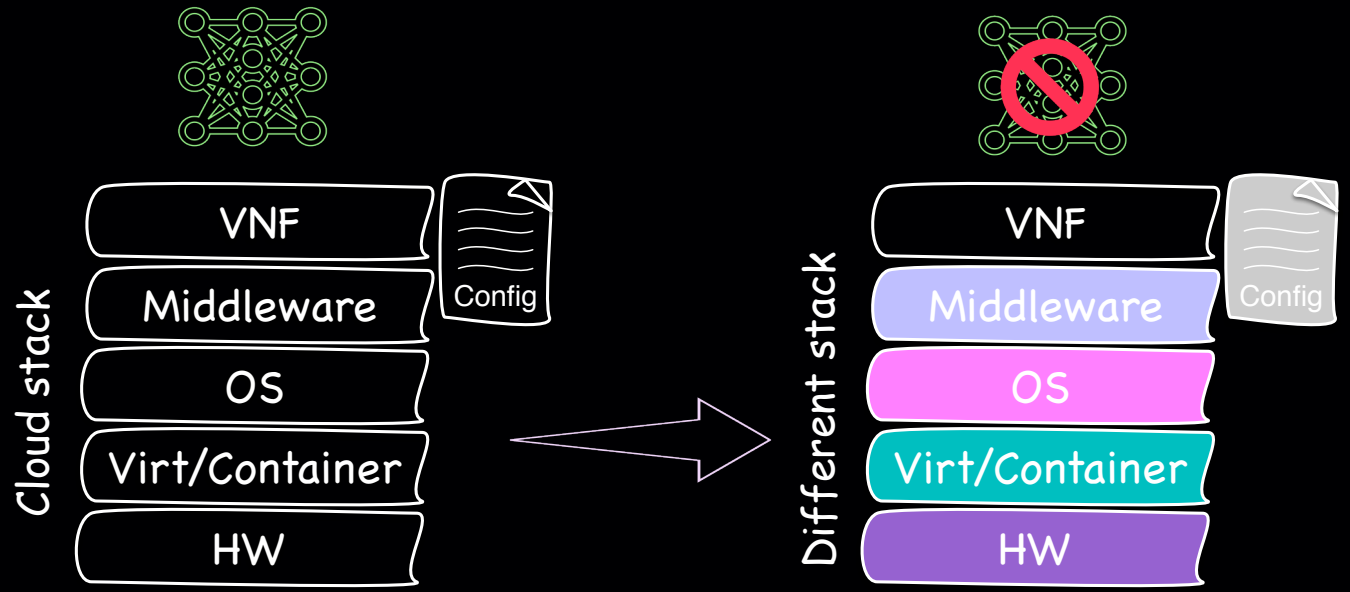

high-dimensional parameter space

Hardware	Virtualization	Operating System	Application/VNF	Test case
CPU clock rate [GHz]	Hypervisor (e.g., ESXi 6.5)	Kernel (e.g., Linux 5.3.7)	Build (e.g. stable, 1.0.1)	Workload type (e.g. data)
Number of cores [#]	Cluster size [#]	ulimits [list]	Runtime env. (e.g., JVM)	Traffic model (e.g., self-similar)
RAM [GB]	DPDK [on/off]	FS/disk [ext4]	Features enabled [list]	Form Factor (e.g., surge)
Disk size [GB]	SR-IOV [on/off]	Swap size [GB]	Service Chain [list]	System Under Test (e.g., DB)
Hyper-Threading [on/off]	CPU pinning [on/off]	Page size [KB]	Slicing [#]	Test type (e.g., endurance)
Number of thread [#]	vCPU [#]	CPU gov. (e.g., ondemand)	Elasticity [yes/no]	Fault injection [list]
...	...	...	...	...

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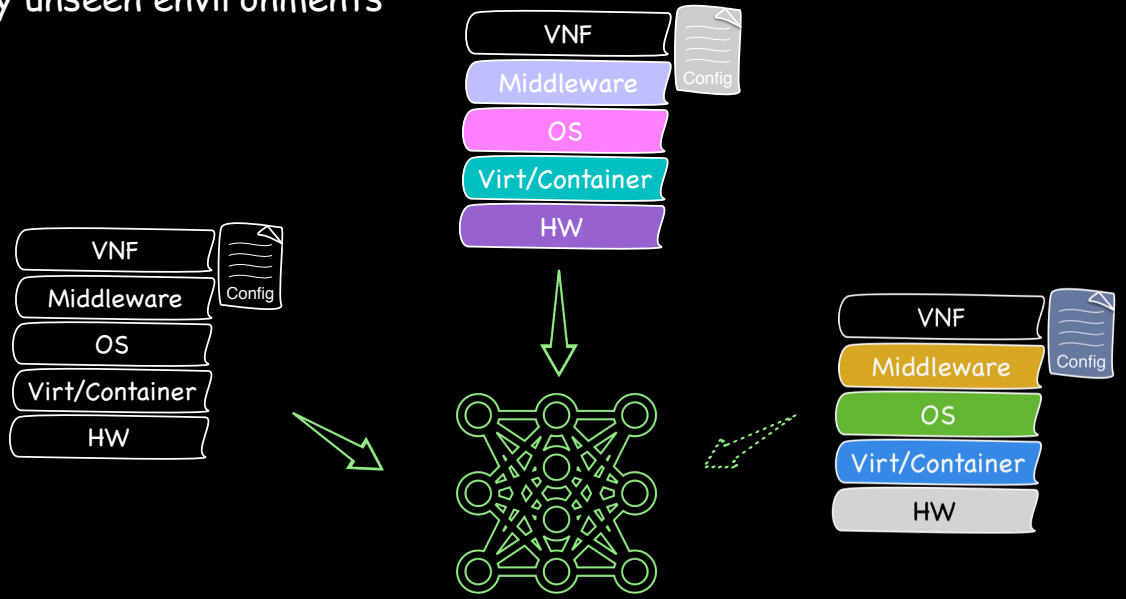
Accelerating VNF Testing with Deep Learning

1) Robust to environment variations
2) Simple single ML model
3) Work in previously unseen environments



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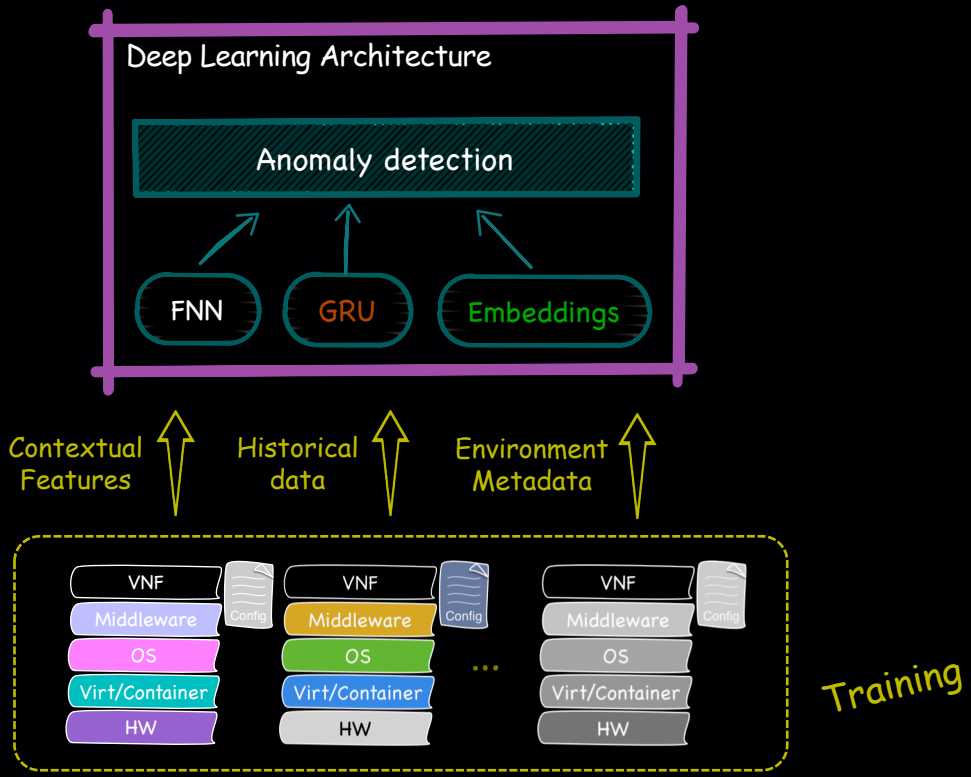
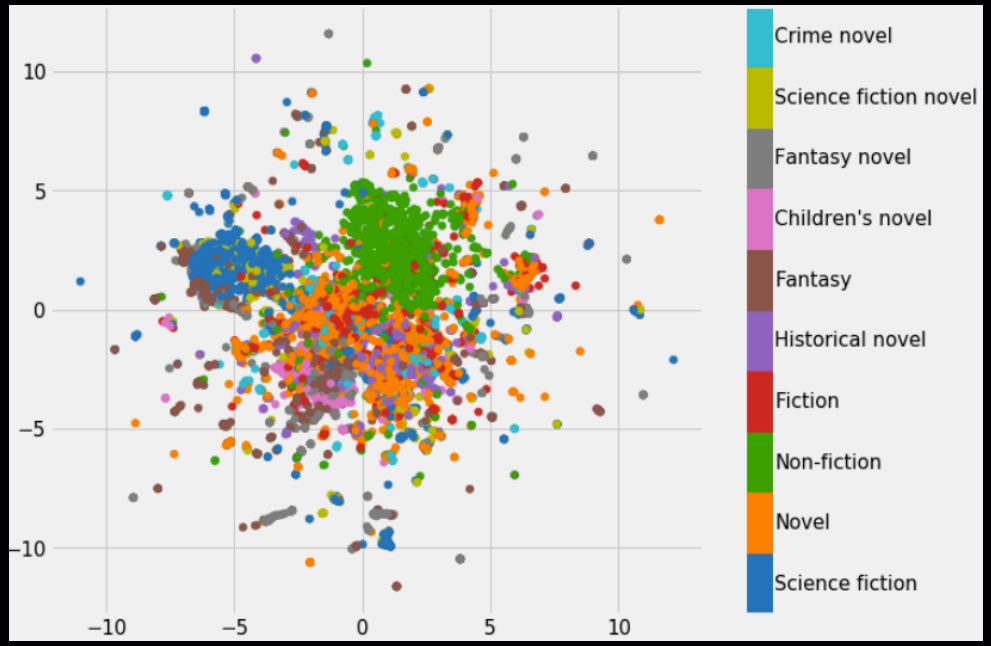


FNN: FeedForward Neural Network

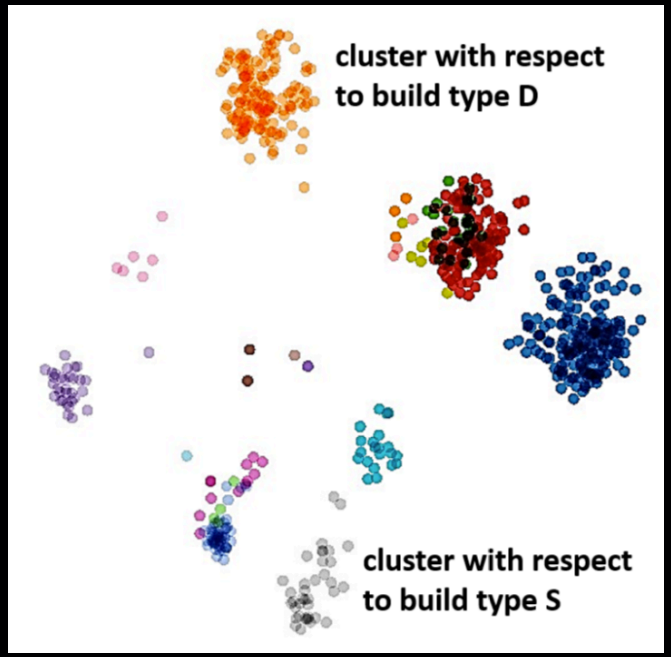
GRU: Gated Recurrent Units

Book (wikipedia) embeddings by genre



@github: WillKoehrsen/wikipedia-data-science

Environments Embeddings by test case



Build type D (debug), T (test), S (stable), etc.

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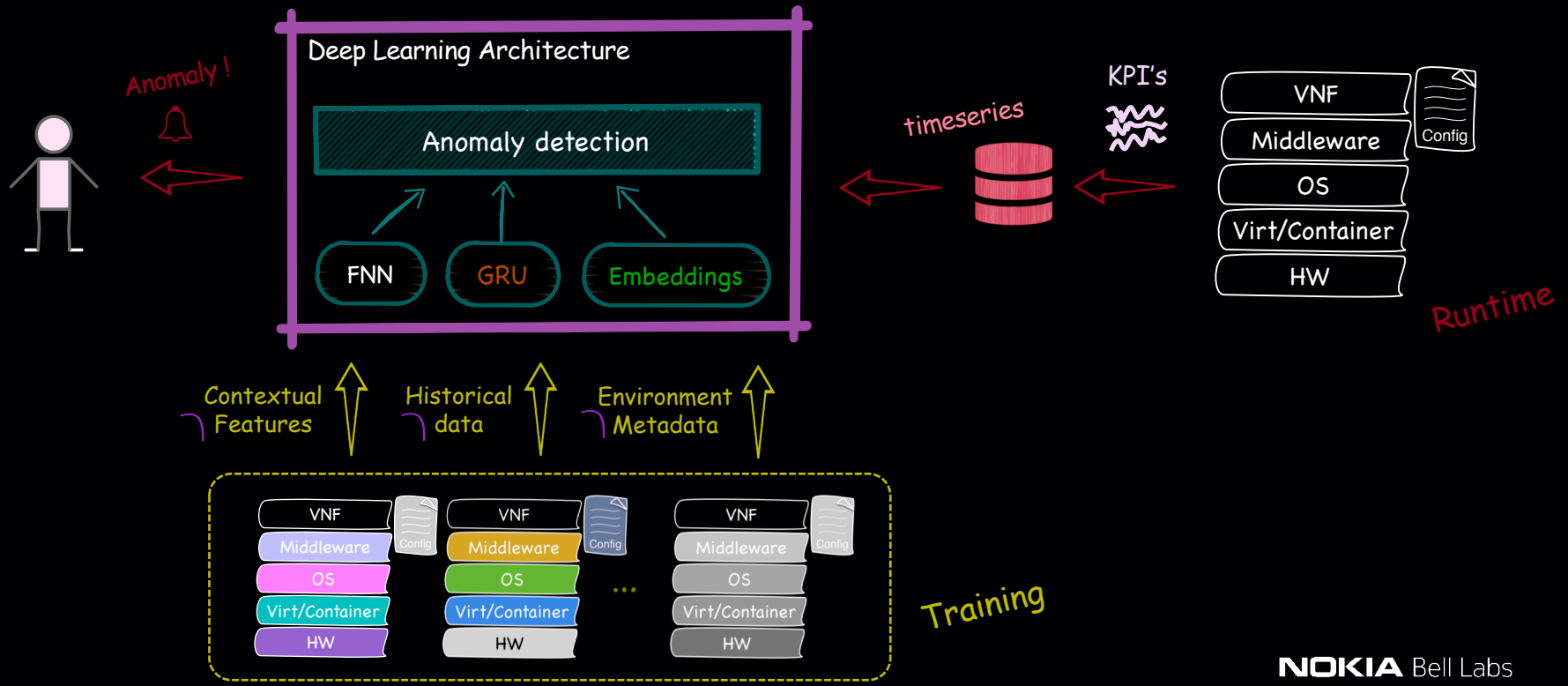

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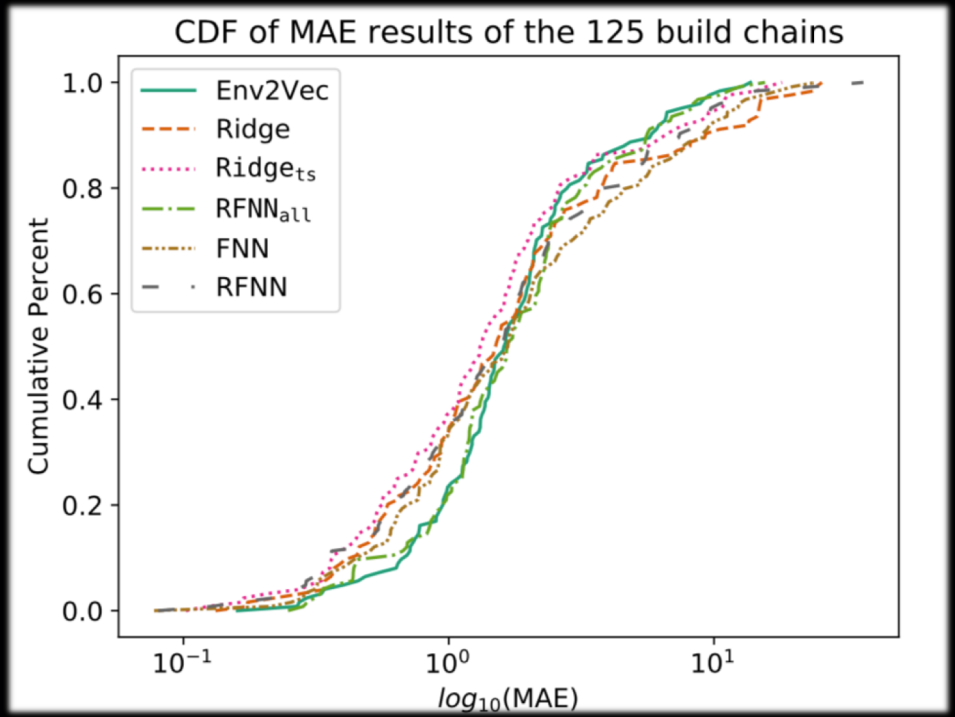
KDN dataset (public)
- Open Virtual Switch
- Snort
- SDN-enabled firewall

Carrier-grade VNF for multiple
- Testing environments
- Build types
- Services Under test

Accuracy 86.2% - 100%
False alarms reduced by 20.9% to 38.1%



Simplified adoption: single model competitive against multi-model proposals

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