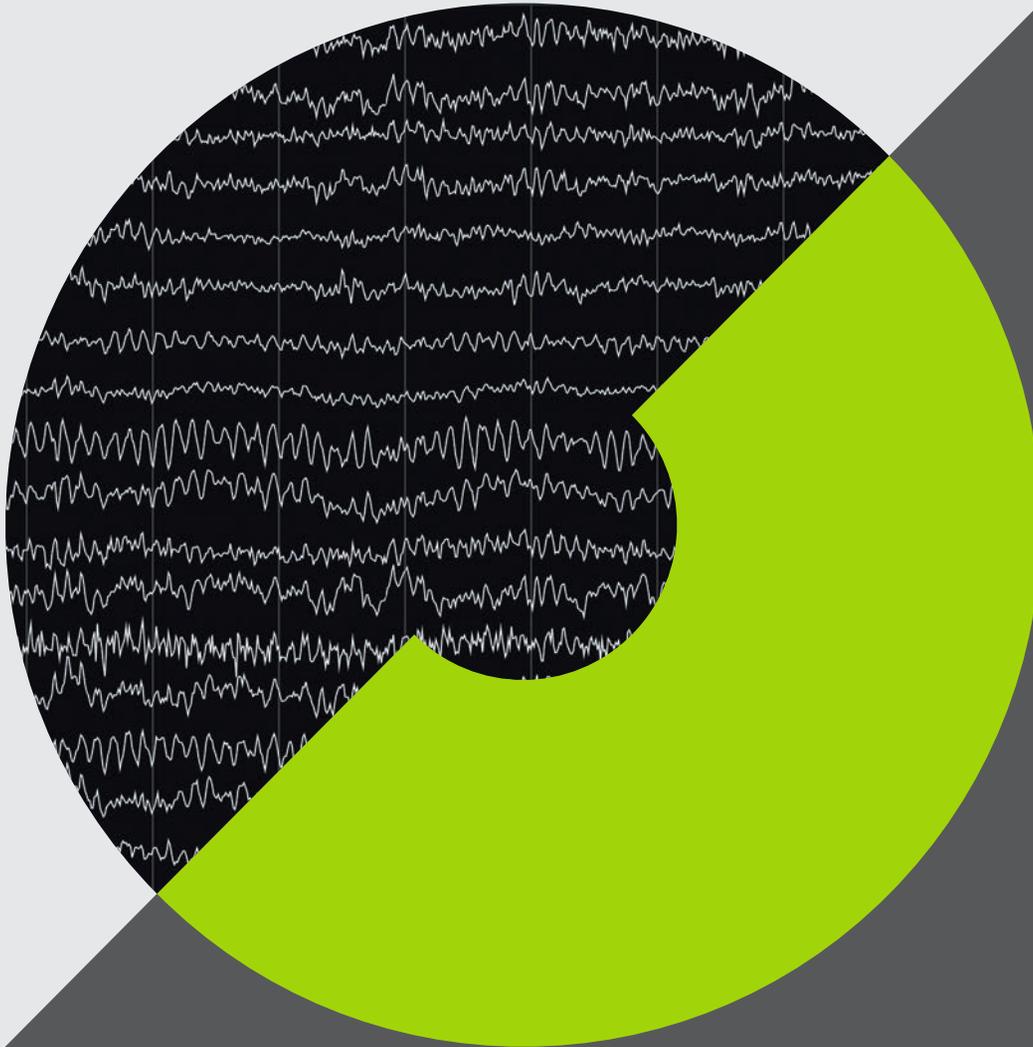NEUROPRO
VMLPRO EEG

The virtual
mobile laboratory.

neuropro.ch/vmlpro

About VMLpro

The Virtual Mobile Laboratory (VML) facilitates the collation, curation, collaboration and computation of extremely large EEG data sets from anywhere at anytime.

Key features

- Flexible cloud-storage
- Rapid, scalable parallel processing
- Database management
- Scrollable and scalable EEG viewer
- Annotation and event marking
- Bandpass and notch filtering
- Electrode montages / referencing
- Power spectrum and spectrogram computation
- Expandable analytics through plug-ins
- Device-cloud-client data streaming
- Light weight clients
- Secure collaboration

Rapid, parallel processing advances research through high-performance cloud computing, scalable across thousands of cores, increasing throughput and accelerating discovery.

By taking advantage of scalable, massively parallel cloud computing delivered as software as a service (SaaS), VMLpro allows users to take their analyses (kBs) to their data (TBs) and then distributes the results, in real-time, to their network of collaborators without the barriers of institutional firewalls.

EEG recordings, metadata and analysis routines (plug-ins) are uploaded to the cloud. Sensitive patient data are encrypted and stored independently of anonymised data and linked via a unique encrypted key to ensure data security.

Storage capacity and processing nodes are scaled automatically to meet current requirements thus optimising the user's computing needs in real-time, avoiding redundancies in data duplication and ensuring users have persistent access to data, and the most recent versions of analytics.

*VMLpro is a solution providing researchers and healthcare professionals with the ability to easily leverage the latest developments in cloud computing technology, **radically reducing the time** of conventional data analysis at a **fraction of the traditional computing costs**.*
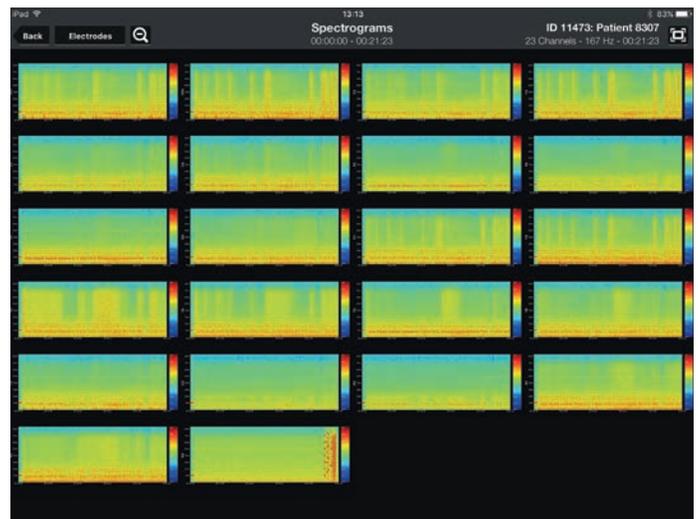
Dr Jamil El-Imad
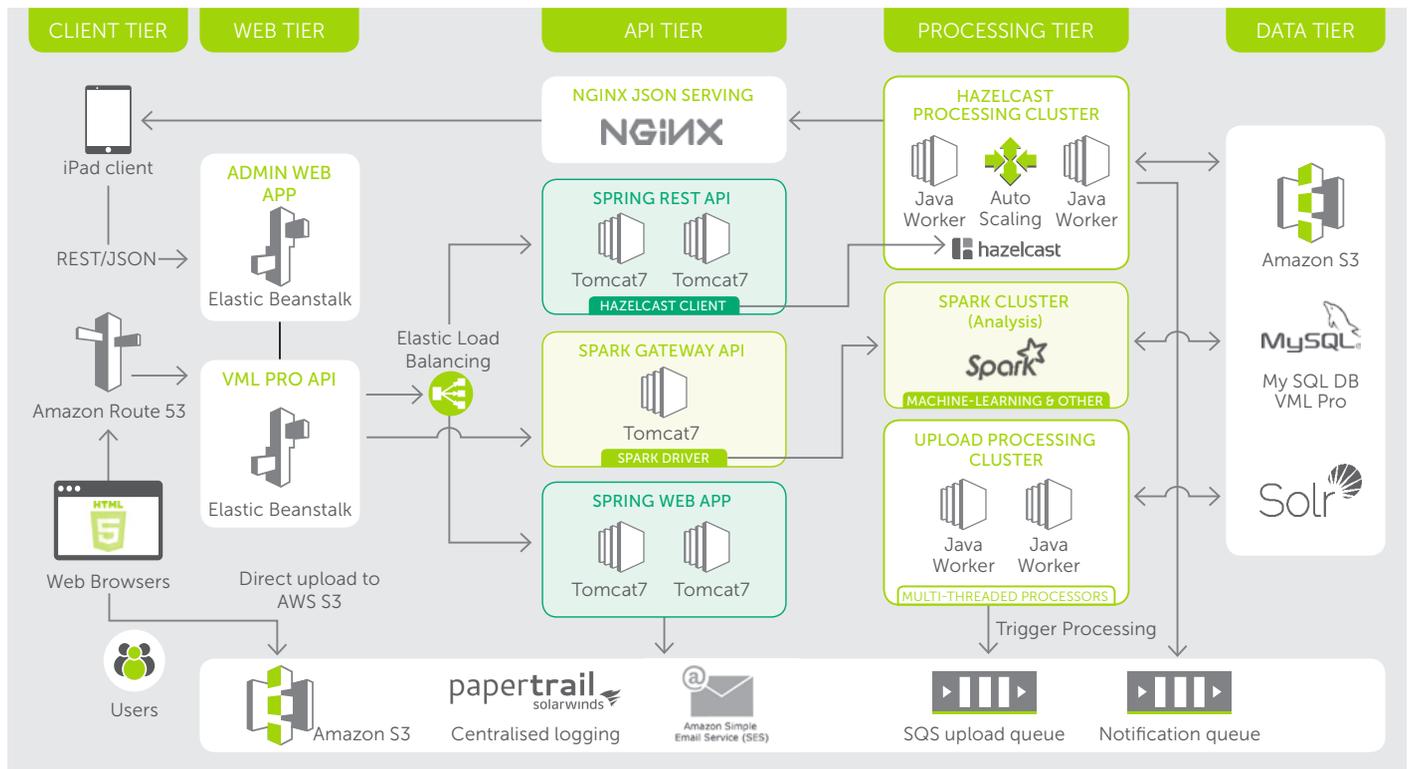Managing Director and Chief Scientist, NeuroPro AG.

Clients / User-interface

Intuitive, interactive signal viewer

Server analytics returned to client rapidly

Architecture Diagram

CLIENT TIER | **WEB TIER** | **API TIER** | **PROCESSING TIER** | **DATA TIER**

iPad client

REST/JSON →

Amazon Route 53

Web Browsers

Users

Direct upload to AWS S3

ADMIN WEB APP
Elastic Beanstalk

VML PRO API
Elastic Beanstalk

Elastic Load Balancing

NGINX JSON SERVING
NGINX

SPRING REST API
Tomcat7 — Tomcat7
HAZELCAST CLIENT

SPARK GATEWAY API
Tomcat7
SPARK DRIVER

SPRING WEB APP
Tomcat7 — Tomcat7

HAZELCAST PROCESSING CLUSTER
Java Worker — Auto Scaling — Java Worker
hazelcast

SPARK CLUSTER (Analysis)
Spark
MACHINE-LEARNING & OTHER

UPLOAD PROCESSING CLUSTER
Java Worker — Java Worker
MULTI-THREADED PROCESSORS

Trigger Processing

Amazon S3 — Centralised logging (papertrail solarwinds) — Amazon Simple Email Service (SES) — SQS upload queue — Notification queue

DATA TIER
Amazon S3

MySQL
My SQL DB VML Pro

Solr

Technology

Platform infrastructure

- Latest technologies from Amazon Web Services (AWS)
- Decoupled and distributed: no single point of failure
- Load balancing to handle growing users / databases
- Disposable analysis servers (Spark on EC2)
- On demand platform scaling
- Improved cost efficiency
- EDF, HDF5 and NXE data formats supported
- JSON / REST API supports Android, iOS and web clients

Batch and real time analysis

- Supervised and unsupervised machine learning algorithms
- Run R, Python, Scala and Java code in the same cluster

Security

- SSL communication between clients and servers
- Encrypted user repository (at rest and in transit)
- Multi-tenant access privileges
- Fully audited API calls
- AWS firewalls protect database and analysis servers
- Multi-factor authentication

Support

- Centralised error logs via Papertrail
- Help desk for bugs, issues and requests within 24 hours

Applications

- EEG research
- Clinical data management
- Research data management
- QEEG and standardised reporting
- Big data analytics
- Machine learning for EEG biomarker detection
- Seizure detection
- Remote telemonitoring
- Remote teleneurofeedback
- Patient led research
- Algorithm processing, validation and collaboration

Ongoing projects

- Standardisation of TMS-EEG implementation and analysis
- Inter-institutional brain data storage and analysis platform for improving patient outcomes in epilepsy
- EEG biomarker detection and validation

NEURO•PRO

Who we are

NeuroPro incorporates specialists from the fields of computer science, neurophysiology, bioengineering, and product and user-interface design. This combination of skills allows us to adopt an informed inter-disciplinary approach to the specific challenges facing those working in brain science.

Our tools for monitoring and analysing brain activity will contribute to accelerating brain research by supporting researchers, clinicians and innovators in pushing the boundaries of brain science and its applications.

Our tools provide an advanced platform for the development of a wide range of health and wellness applications from supporting the development of brain observatories to remote telemonitoring, patient led research, neurofeedback and cognitive wellness. Additionally, NeuroPro's tools are relevant to innovative entertainment, lifestyle and interaction solutions driven by brain computer interface technologies.

Contact us

Partnership is a key element in the way we work. We collaborate with globaal leaders in the design, development and implementation of our products and welcome new collaborations.

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