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TESTING TECHNOLOGIES IN A 5G TEST NW

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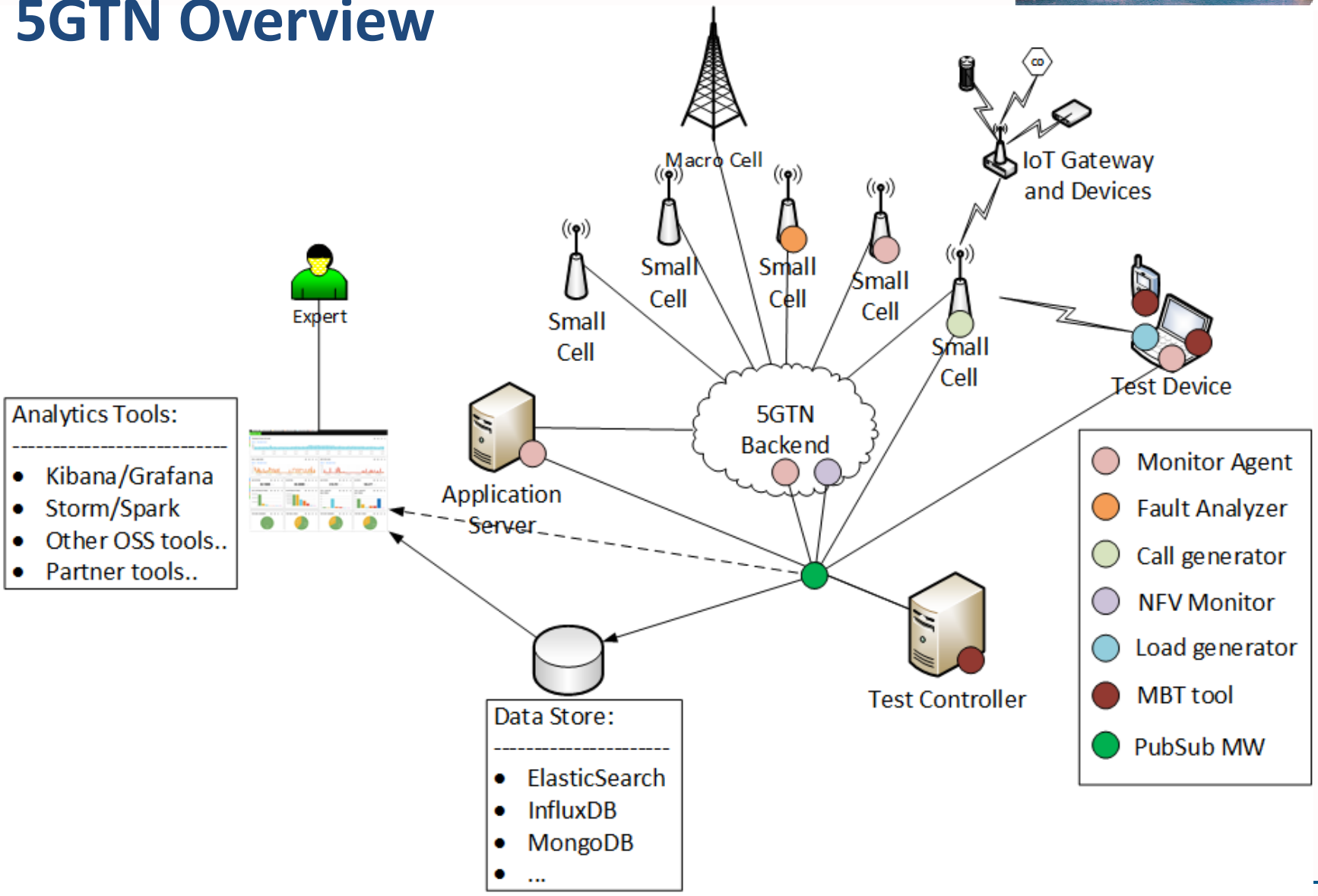
Background

- The 5GTN project started early 2015, with VTT, UoO and 15 industry partners, evolves over time
- Partners from different domains
  - HW providers
  - Test & monitoring tool vendors
  - Research & Analytics
  - Business & NW operations

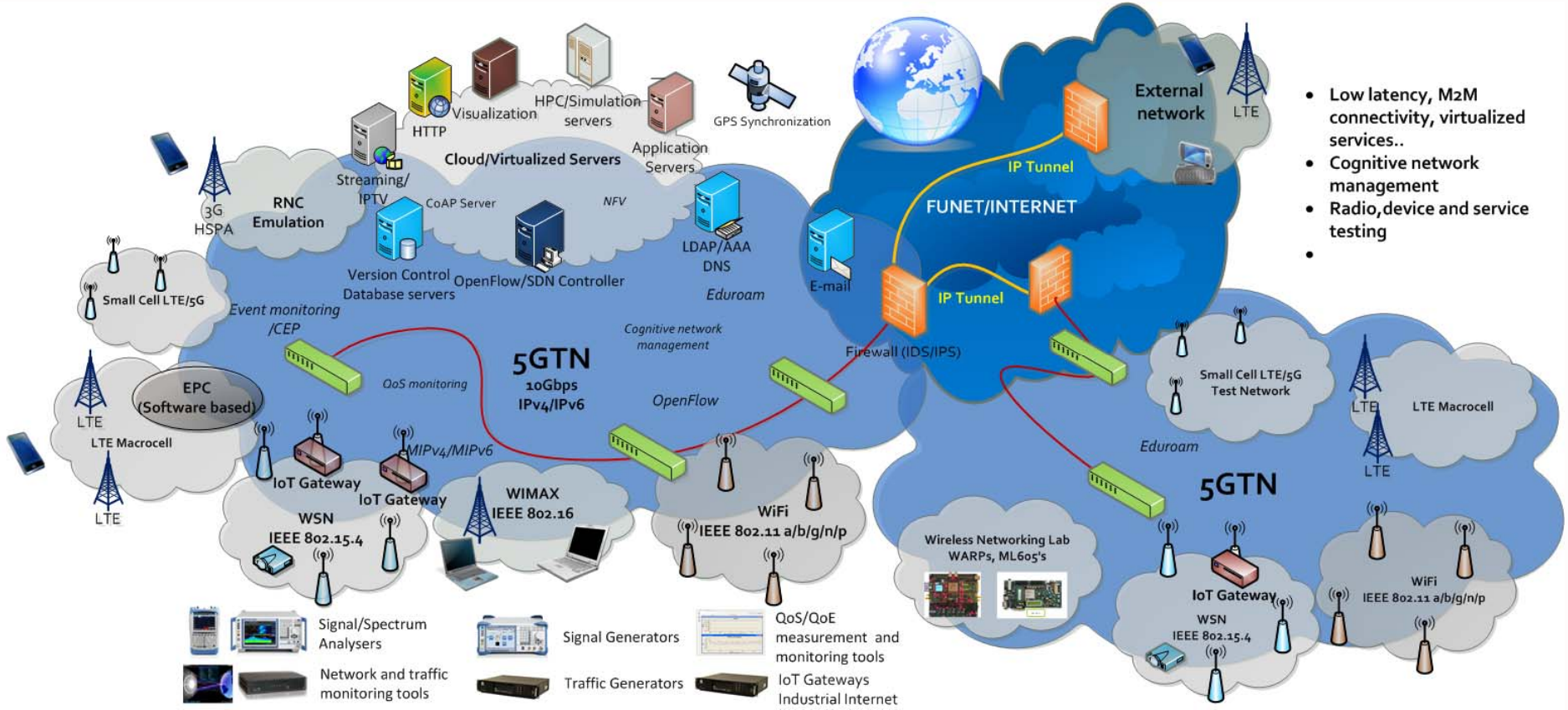
Background

- Example high-level use cases:
  - Technical tests for 5G components
  - Test tool integration & use in realistic network environment
  - Dynamic small cell topologies & network adaptation
  - IoT devices and services testing
- Testing tech.support tests execution and analytics
  - New applications, services and networking solutions
  - 3rd party applications, services, algorithms, systems testing
  - Virtualized services

5GTN Overview



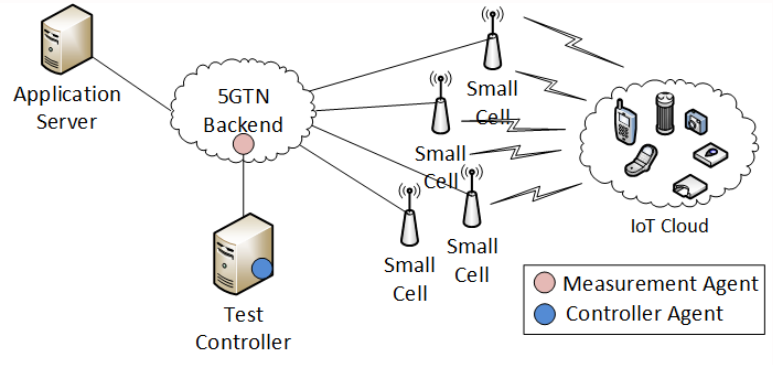
5GTN in Context



Example Test Tools

- Traffic generation
  - HTTP(S) upload/download/ browsing, (S)FTP
  - Video streaming
  - Voice/Video calls
  - TCP/UDP data streams
  - Traffic/user profiles (MBT)
- Test control:
  - Traffic gen. and meas. control on distributed NW
  - Adapting to responses

- Monitoring tools (QoS)
  - UL/DL delay, jitter, packet loss, load
  - Voice/video quality
  - Traffic details, e.g., HTTP/TCP
  - Call setups, handovers, etc.

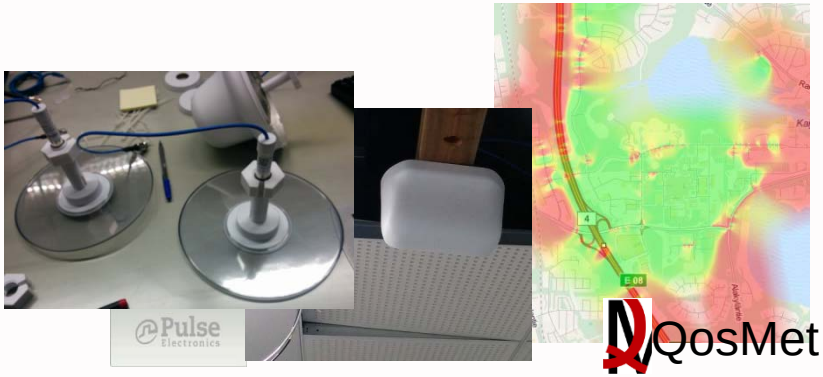


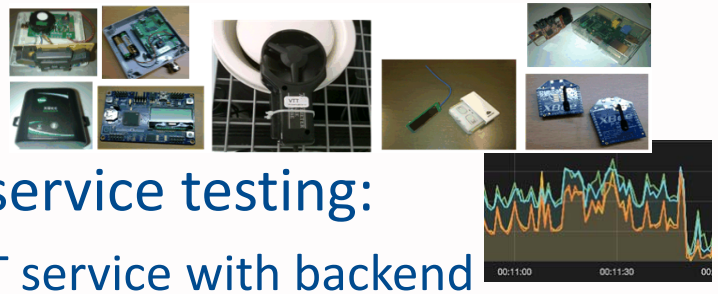
Example Analytics Tools

- Visualizations
  - ElasticSearch/Kibana
  - InfluxDB/Grafana
  - Custom/Partner solutions, e.g. coverage/qos maps
- Stream/BD Analytics
  - Apache Storm
  - Apache Spark
  - Custom/Partner solutions, e.g. specific logs/faults
- Example use cases
  - Application profiling
    - Performance
    - Resource use
    - NW load impact
  - Optimization
    - QoS parameters on NW and service level
  - Input to other phases
    - NW management

Example Test Scenarios

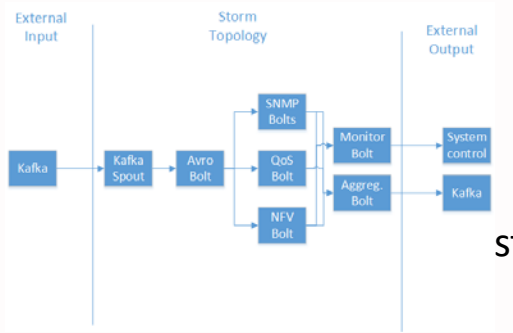
- Antenna Testing:
  - Different types of antennas installed on indoor small cells
  - Traffic generation and QoS parameter measurement for different configurations
  - Analysis of results, QoS visualizations

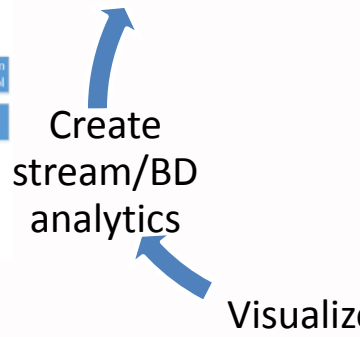


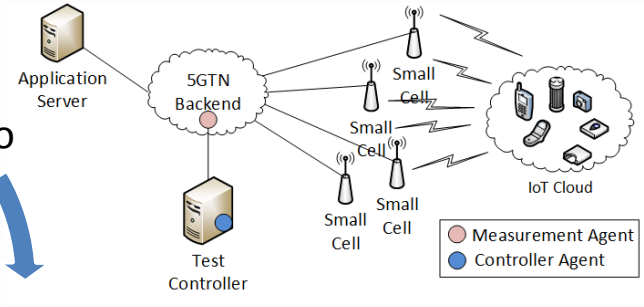


- IoT service testing:
  - IoT service with backend server and sensors
  - Data streaming over different network paths using diverse protocols, e.g. through gateways over small cells
  - Analysis of service QoS attributes, network parameters impact, guided load generation
  - LTE-M etc.

Process







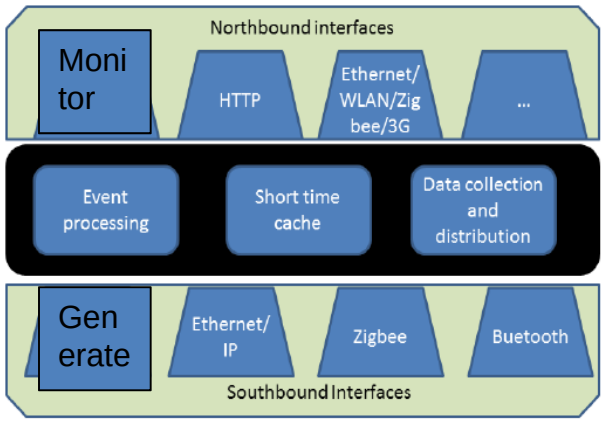
IoT Gateway Example

Monitor

- Sensor data is passed through the GW
- We capture all events published on the GW
- Aggregate on time-window (e.g. sum in 1s)
- Publish stats over Kafka

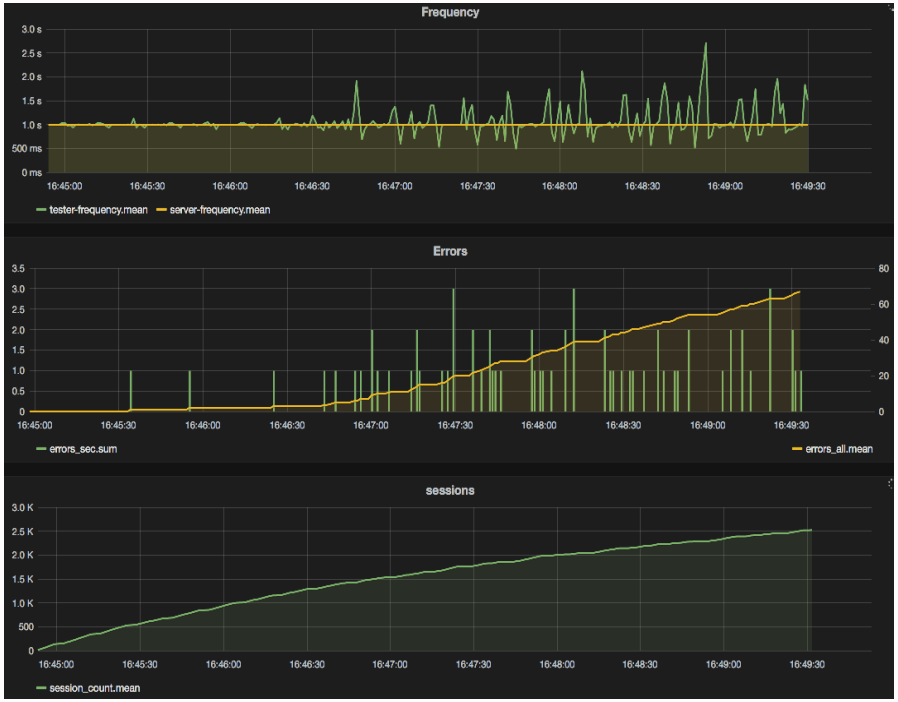
Generate

- Use profiles to create ”real” data



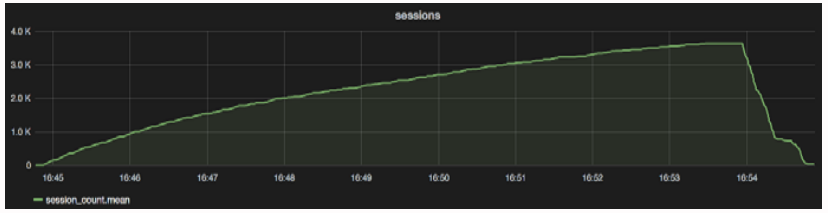
Application Specific Monitoring

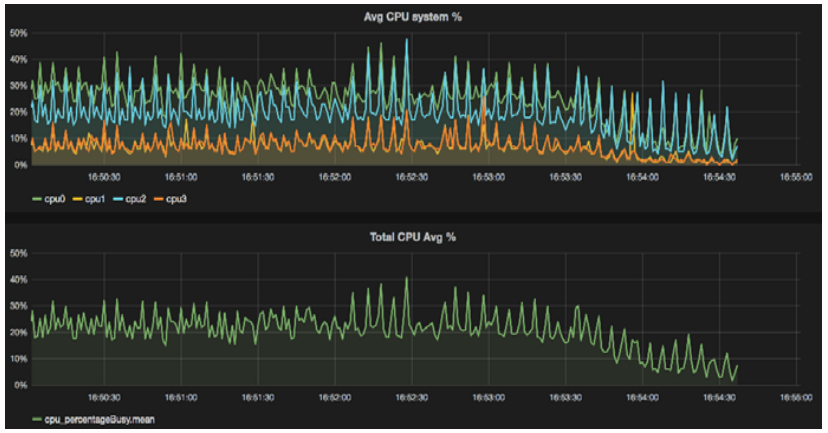
- Server side monitoring also used in production
- Tester vs server frequency
- Clients delay variation increase as more sessions
- Communication error rates increase with sessions
- Here we increase load in different environments, monitor applications, servers, clients, network,…

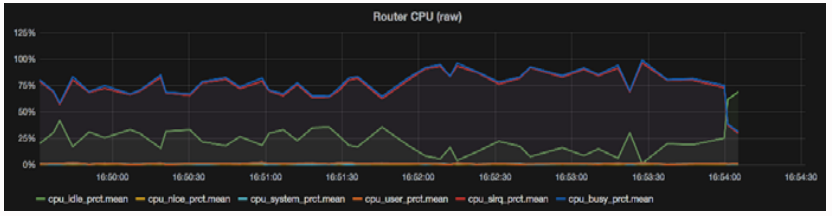


Feedback-directed test generation

- Poll the data stream for metrics of interest
- Use this to direct how test flow
- E.g., increase sessions until CPU load > 90%
  - OS limits,
  - Dangling sessions,
  - NW element limits
- Add more params, analytics, etc.

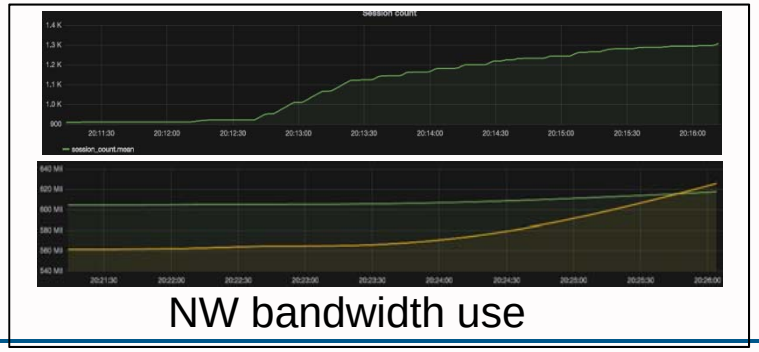




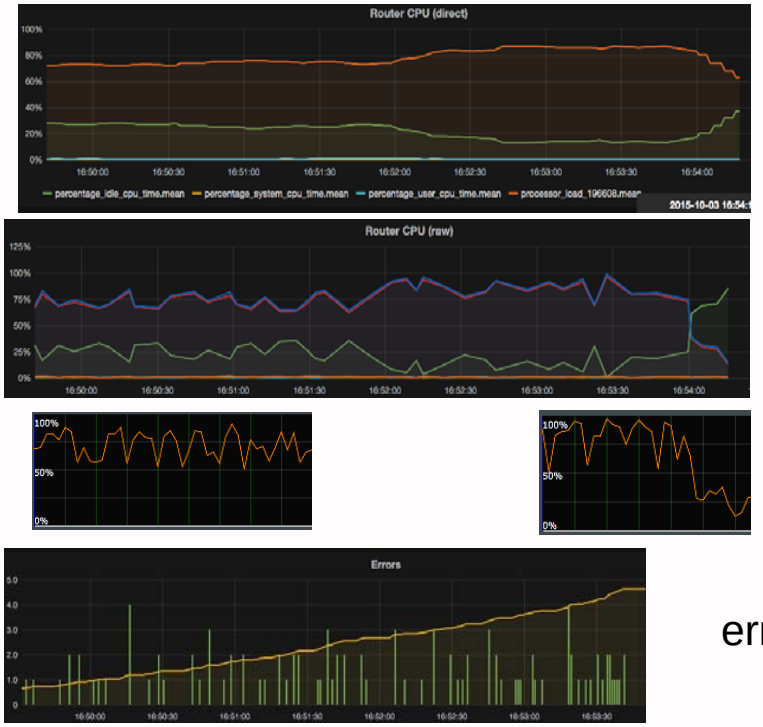


Some Data Analytics Concerns

- Often not clear what data we need or how to get it,
- Different purposes require data at different granularity
  - Which can be limited
  - E.g., how do you find causes?
- Visualization is good but not always enough alone



NW bandwidth use



1min

5s

1s

errors

Router load vs NW errors?

Example measurements/sources

General

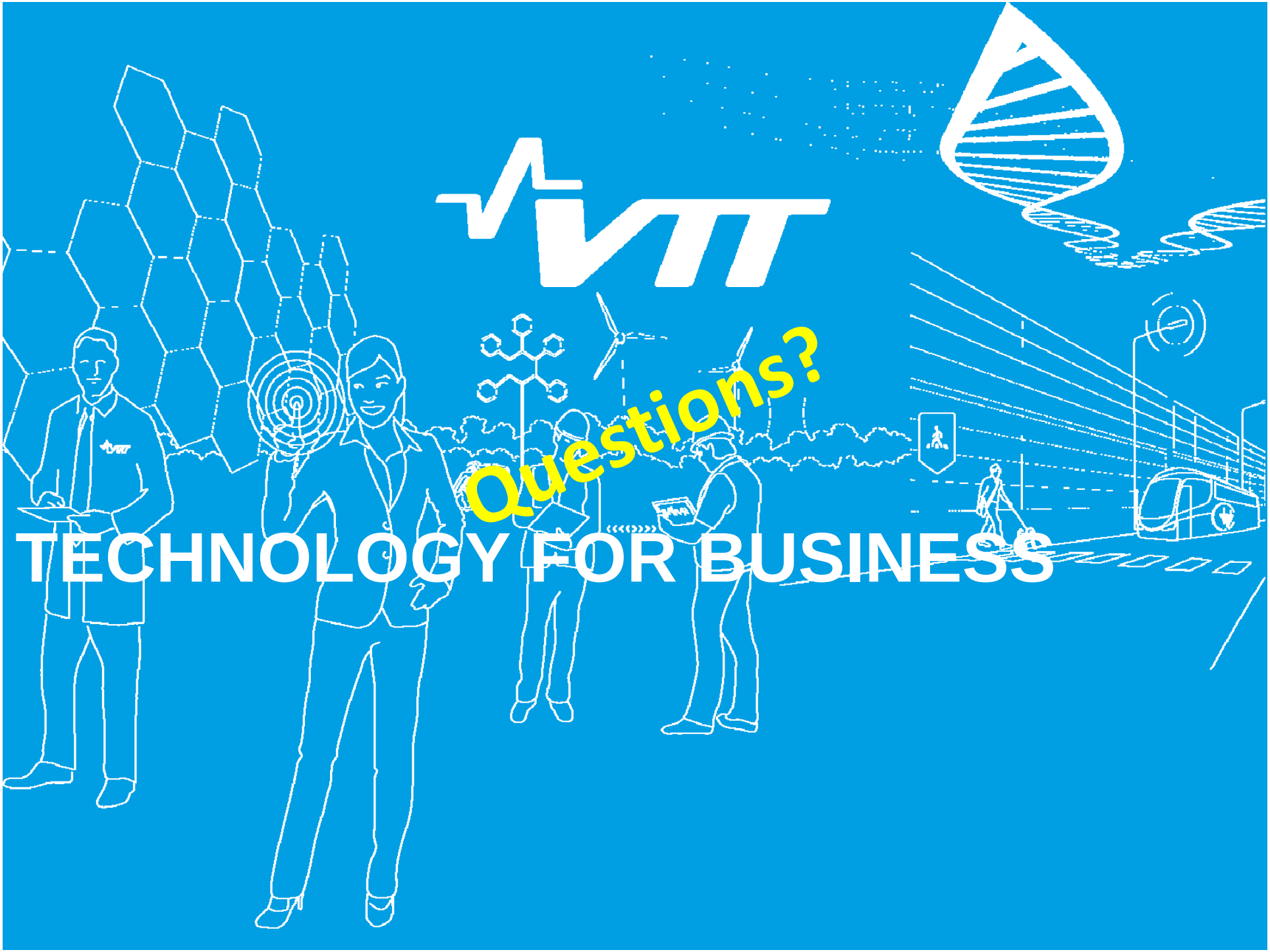
- SNMP
- QoSMet
- Telegraf
- Openstack API's
- Core network interfaces
- NW device interfaces

Specific

- Web traffic, e.g. Selenium driver with proxy
  - Request count, size, etc.
- IoT gateway sensor event statistics
- Application specific ,e.g.,
  - sessions,
  - power use,

Conclusions

- An environment for testing attributes such as performance, interoperability
- As a service for project partners to try test tools, test services, test products (e.g., IoT)
- Tools for test generation, monitoring, analytics
- Development and additional scenarios ongoing
- For a broader overview, see:
  - M. Latva-Aho, A. Pouttu, A. Hekkala, I. Harjula, J. Mäkelä, "Small Cell Based 5G Test Network (5GTN)", 12th Int'l. Symp. on Wireless Comm. Systems, Brussels, Belgium, 25-28.8.2015.
  - www.5gtn.fi, www.5gtnf.fi


Questions?
TECHNOLOGY FOR BUSINESS