Nokia Position statement W3C Workshop on Web5G

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5G has been under development for few years already. Wide scale deployment is foreseen to ramp-up in 2018, with 5G massively deployed by 2020 timeframe. 5G main value propositions include (but are not limited to):

- Enhanced mobile broadband access
- Support for ultra-reliable and low latency communications
- Support for massive IoT

At the technology level, 5G main **core network advancements** include:

- **New core network** leveraging the principles of Service Based Architectures (SBA). Its design adheres to NFV and cloud native principles to provide benefits pertaining to flexibility, high throughput, high availability, low latency, etc. SBA is designed to be microservices oriented where communications is performed using Web advancements: REST style communication patterns with HTTP/2 as application protocol and JSON serialisation.
- **Network virtualisation and slicing:** 5G is designed from the ground-up to be a true multi-service network. To achieve flexibility while mastering the total cost of ownership, the core network has been fully virtualised so that it can run on CSP cloud infrastructures. Network slicing offers the possibility to build virtual network instances customized for specific customer or vertical industry needs. The use of network slicing at RAN and Core network levels provides isolation, flexibility and reliability.
- **Multi-access edge computing and application enablement:** Edge computing enables operators and 3rd party services to be hosted close to the field devices. The Application intelligence would run on the CSP infrastructure (instead of centralised clouds) to provide low latency, mobility, and get access to exposed network capabilities such as local routing, QoS, RNIS, etc…
- **Exposure of network capabilities:** while not specific feature of 5G per se, the exposure of network capabilities to applications has been further enhanced and extended in the context of 5G. 5G developments in 3GPP (Release 15) introduce NEF (Network Exposure Function) which is an integral part of the Service Based Architecture. Other network exposure initiatives are also worth mentioning:
    - **Service Capability Exposure Framework (SCEF):** designed in the context of 4G *mostly* to expose cellular IoT services including NB-IoT and LTE-M
    - **Common API Framework (CAPIF) for 3GPP Northbound APIs:** provides guidelines and common API functionalities (e.g. authentication of API invoker, authorisation to access service APIs, discovery of service APIs) to third party applications
    - **Open Mobile Alliance (OMA) APIs for accessing 3GPP network resources** such as presence, call control, terminal location, etc.

The following table provides **examples (not an exhaustive list)** of APIs that are exposed to third party application developers:

SCEF API examples	NEF API examples	OMA API example
- Monitoring (e.g. loss of connectivity, IMSI-IMEI association, location, etc.) - Non-IP Data Delivery - Device Triggering - Group Message Delivery - Communication Pattern provisioning - Packet Flow Description Management - Setting-up QoS sessions - Resource management of Background Data Transfer	- Monitoring - Device Triggering - Communication Patterns provisioning - Packet Flow Description Management - Resource management of Background Data Transfer - Procedures for Traffic Influence	- Terminal location - Presence - Payment - Multimedia messaging - Device capabilities - Call control APIs - Etc.

While there have been initial discussions about exposure of management and monitoring of network slices to ASPs, **it is perceived that more time would be needed to build operational experience pertaining to the lifecycle management of network slices**. The following provides some possible attributes of network slices: QoS policy, Security mechanisms, frequency bands, edge and cloud computing capabilities, bandwidth, resiliency, isolation, etc

Conclusion and recommendations

There are clear benefits in exposing an increasingly rich set of network capabilities to third party application developers. Initial API standardisation work started in 3GPP both in bottom-up but also top-down manner (e.g. SCEF work triggered by oneM2M). **Enhancing current developments in a top-down manner with requirements from web developers will be key in building win-win scenarios for CSPs and ASPs.** Further work on use cases will help improve current API ongoing developments for NEF (in the context of 5G). An incremental approach, taking into account lessons learnt from operational deployments is equally important for future success.