**3GPP TSG-SA5 Meeting #156 *S5-244698***

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**Source: Nokia, Huawei, NTT DOCOMO**

**Title: Rel-19 pCR TR 28.869 Add background info on cloud-native design principles and their relevance to 3GPP OAM**

**Document for: Approval**

**Agenda Item: 6.19.6**

# 1 Decision/action requested

***In this box give a very clear / short /concise statement of what is wanted.***

# 2 References

[1] 3GPP TR 28.869, " Study on cloud aspects for management and orchestration."

# 3 Rationale

Currently, TR 28.869[1] refers to the term cloud-native network functions throughout the document. The cloud-native network functions have been linked to cloud-native design principles without a proper definition of what these cloud-native design principles are. In addition, it remains unclear what is the relevance of the cloud-native design principles to 3GPP network functions.

# 4 Detailed proposal

This pCR proposes to add background information on cloud-native design principles and their relevance to 3GPP OAM to clause 4 of TR 28.869 [1].

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| **First Change** |

# 2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non‑specific.

- For a specific reference, subsequent revisions do not apply.

- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

[1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[2] ETSI GS NFV-IFA 049: “Network Functions Virtualisation (NFV) Release 5; Architectural Framework; VNF generic OAM functions specification.

[3] ETSI GR NFV-EVE 019: "Network Functions Virtualisation (NFV) ;Architectural Framework;Report on VNF generic OAM functions".

[4]  3GPP TR 28.834: "Study on management of cloud-native Virtualized Network Functions (VNF)".

[5] SP-230764 New WID on Management of cloud-native Virtualized Network Functions.

[6] 3GPP TS 28.526: "Telecommunication management; Life Cycle Management (LCM) for mobile networks that include virtualized network functions; Procedures".

[7] 3GPP TS 28.531: “Management and orchestration; Provisioning”.

[8] ETSI GS NFV-IFA 013 (V4.5.1) (2023-09): "Network Function Virtualisation (NFV); Release 4; Management and Orchestration; Os-Ma-nfvo reference point - Interface and Information Model Specification".

[9] ETSI GS NFV-IFA 008 (V4.3.1) (2022-05): "Network Function Virtualisation (NFV); Release 4; Management and Orchestration; Ve-Vnfm reference point - Interface and Information Model Specification".

[10] 3GPP TR 28.532: “Management and orchestration; Generic management services”.

[11] ETSI GR NFV 003 (V1.8.3): "Network Functions Virtualisation (NFV); Terminology for Main Concepts in NFV".

[12] 3GPP TS 28.555: "Management and orchestration; Network policy management for 5G mobile networks; Stage 1".

[13] ETSI GR NFV-IFA 023 (V3.1.1): "Network Functions Virtualisation (NFV); Management and Orchestration; Report on Policy Management in MANO; Release 3".

[14] 3GPP TS 28.552: " Management and orchestration; 5G performance measurements ".

[15] 3GPP TS 28.554: "Management and orchestration; 5G end to end Key Performance Indicators (KPIs)".

1. 3GPP TS 28.533: “Management and orchestration; Architecture framework”.

[17] 3GPP TS 28.541: "Management and orchestration; 5G Network Resource Model (NRM); Stage 2 and stage 3".

[18] ETSI GS NFV 006: "Network Functions Virtualisation (NFV) Release 4; Management and Orchestration; Architectural Framework Specification".

[19] ETSI GS NFV-IFA 007: "Network Functions Virtualisation (NFV) Release 5; Management and Orchestration; Or-Vnfm reference point - Interface and Information Model Specification".

[20] ETSI GS NFV-IFA 008: "Network Functions Virtualisation (NFV) Release 5; Management and Orchestration; Ve-Vnfm reference point - Interface and Information Model Specification".

[21] ETSI GS NFV-IFA 010: "Network Functions Virtualisation (NFV) Release 5; Management and Orchestration; Functional requirements specification".

[22] ETSI GS NFV-IFA 011: "Network Functions Virtualisation (NFV) Release 5; Management and Orchestration; VNF Descriptor and Packaging Specification".

[23] ETSI GS NFV-IFA 013: "Network Functions Virtualisation (NFV) Release 5; Management and Orchestration; Os-Ma-nfvo reference point - Interface and Information Model Specification".

[24] ETSI GS NFV-IFA 014: "Network Functions Virtualisation (NFV) Release 5; Management and Orchestration; Network Service Templates Specification".

[25] ETSI GR NFV-IFA 029: "Network Functions Virtualisation (NFV) Release 3; Architecture;Report on the Enhancements of the NFV architecture towards "Cloud-native" and "PaaS".

[26] ETSI GS NFV-IFA 036: "Network Functions Virtualisation (NFV) Release 5; Management and Orchestration; Requirements for service interfaces and object model for container cluster management and orchestration specification".

[27] ETSI GR NFV-IFA 038: "Network Functions Virtualisation (NFV) Release 4; Architectural Framework; Report on network connectivity for container-based VNF".

[28] ETSI GS NFV-IFA 040: "Network Functions Virtualisation (NFV) Release 5; Management and Orchestration; Requirements for service interfaces and object model for OS container management and orchestration specification".

[29] ETSI GR NFV-IFA 043: "Network Functions Virtualisation (NFV) Release 5; Architectural Framework; Report on enhanced container networking".

[30] ETSI GS NFV-SOL 001: "Network Functions Virtualisation (NFV) Release 5; Protocols and Data Models; NFV descriptors based on TOSCA specification".

[31] ETSI GS NFV-SOL 002: "Network Functions Virtualisation (NFV) Release 5; Protocols and Data Models; RESTful protocols specification for the Ve-Vnfm Reference Point".

[32] ETSI GS NFV-SOL 003: "Network Functions Virtualisation (NFV) Release 5; Protocols and Data Models; RESTful protocols specification for the Or-Vnfm Reference Point".

[33] ETSI GS NFV-SOL 004: "Network Functions Virtualisation (NFV) Release 5; Protocols and Data Models; VNF Package and PNFD Archive specification".

[34] ETSI GS NFV-SOL 005: "Network Functions Virtualisation (NFV) Release 5; Protocols and Data Models; RESTful protocols specification for the Os-Ma-nfvo Reference Point".

[35] ETSI GS NFV-SOL 016: "Network Functions Virtualisation (NFV) Release 4; Protocols and Data Models; NFV-MANO procedures specification".

[36] ETSI GS NFV-SOL 018: "Network Functions Virtualisation (NFV) Release 5; Protocols and Data Models; Profiling specification of protocol and data model solutions for OS Container management and orchestration".

[37] ETSI GS NFV-SOL 020: "Network Functions Virtualisation (NFV) Release 5; Protocols and Data Models Specification of protocols and data models for Container Infrastructure Service Cluster Management".

1. ETSI GS NFV-IFA 027: "Network Functions Virtualisation (NFV) Release 5; Management and Orchestration; Performance Measurements Specification".
2. ETSI GR NFV-EVE 021: "Network Functions Virtualisation (NFV) Release 5; Evolution and Ecosystem;Report on energy efficiency aspects for NFV".
3. ETSI GS NFV-IFA 053: "Network Functions Virtualisation (NFV) Release 5; Management and Orchestration; Requirements and interface specification for Physical Infrastructure Management".

 [X] CNCF Cloud Native Definition v1.1

<https://github.com/cncf/toc/blob/main/DEFINITION.md>

[y] “The twelve-factor app”
https://12factor.net

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| **Second Change** |

## 4. X Cloud-native design principles and their relevance to 3GPP OAM

### 4.X.1 Background on cloud-native design principles

Cloud-native design principles (for network functions and applications in general) are described and documented in various industry standards, frameworks, open-source communities and key organizations in the field of cloud computing but no single standardized definition exists for cloud-native design principles which can be leveraged to articulate a very precise definition of a CNF. Two relevant sources of cloud-native principles are "The twelve-factor app" [y] and the CNCF’s "Cloud-native design principles" [X].

### 4.X.2 Twelve-factor app

Most descriptions of cloud-native design principles trace back to a set of design principles as described in "The twelve-factor app" [y]. These factors are:

1: Codebase: One codebase tracked in revision control, many deploys

2: Dependencies: Explicitly declare and isolate dependencies

3: Configuration: Store config in the environment

4: Backing services: Treat backing services as attached resources

5: Build, release, and run: Strictly separate build and run stages

6: Processes: Execute the app as one or more stateless processes

7: Port binding: Export services via port binding

8: Concurrency: Scale out via the process model

9: Disposability: Maximize robustness with fast startup and graceful shutdown

10: Dev/Prod parity: Keep development, staging, and production as similar as possible

11: Logs: Treat logs as event streams

12: Administrative processes: Run admin/management tasks as one-off processes

### 4.X.3 CNCF’s cloud-native principles

Other industry-recognized cloud-native design principles [X] are:

- Micro-services design

- Loosely coupled: implies that each micro-service composing a cloud-native application is a small independent deployable unit. This principle enables each micro-service to evolve independently of the other micro-services.

- Containerization: Micro-services and their dependencies are packaged into containers that can run independently across all environments and host operating systems.

- Repeatable deployment process: Since cloud-native applications are based on containers, the deployment process of cloud-native applications is reproducible, consistent, and thus repeatable (i.e., can be automated).

- Immutable infrastructure: implies that the infrastructure hosting the cloud-native applications cannot be modified in place. Modifications are only possible by building new infrastructure templates and then rebuilding relevant infrastructure using those templates.

- Declarative API: cloud-native applications use declarative APIs to define what to do (i.e., the desired state) instead of how to do it.

- Observability: monitoring cloud-native applications through access to metrics, logs, and traces should be possible.

- Resiliency: cloud-native applications should be able to tolerate failures by leveraging self-healing mechanisms (e.g., system restarts).

- Dynamic scalability: cloud-native applications should be able to scale up or down dynamically depending on the load conditions.

### 4.X.4 Relevance of cloud-native design principles to 3GPP OAM

Table 4.X.4-1 provides a summary of the potential management impacts on the related "Twelve-factor app" and "CNCF’s cloud-native principles". Where factors and principles are understood to be related, they are indicated on the same row in the table 4.X.4-1.

Editor’s Note: The impact of the cloud-native design principles on the 3GPP management system is TBD.

Table 4.X.4-1: Potential cloud native impacts to 3GPP management

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| Factor | Cloud-native principle | Management impact |
| 1 – Codebase | Repeatable deployment process |  |
| 2 – Dependencies |  |
| 3 – Configuration |  |
| 4 – Backing services |  |
| 5 – Build, release, and run |  |
| 6 – Processes | Micro-services designLoosely coupled |
| 7 – Port binding |  |
| 8 – Concurrency | Dynamic scalability |
| 9 – Disposability | Resiliency |
| 10 – Dev/Prod parity |  |
| 11 – Logs | Observability |
| 12 – Administrative processes |  |
|  | Containerization |
|  | Immutable infrastructure |
|  | Declarative API |

The present document does not study and define the exact set of cloud native principles a CNF adheres to. It is not up to the 3GPP management system to mandate that network functions adhere to cloud-native principles in their design. However, analysis as provided in table 4.X4-1 above implies that from a 3GPP management perspective, a CNF can have the following aspects:

- Highly scalable based on microservices,

- Deployed using container technologies, and

- Multiple management interfaces to support multiple management applications.

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| **End of Changes** |