5G Network Slicing and Orchestration
Demo

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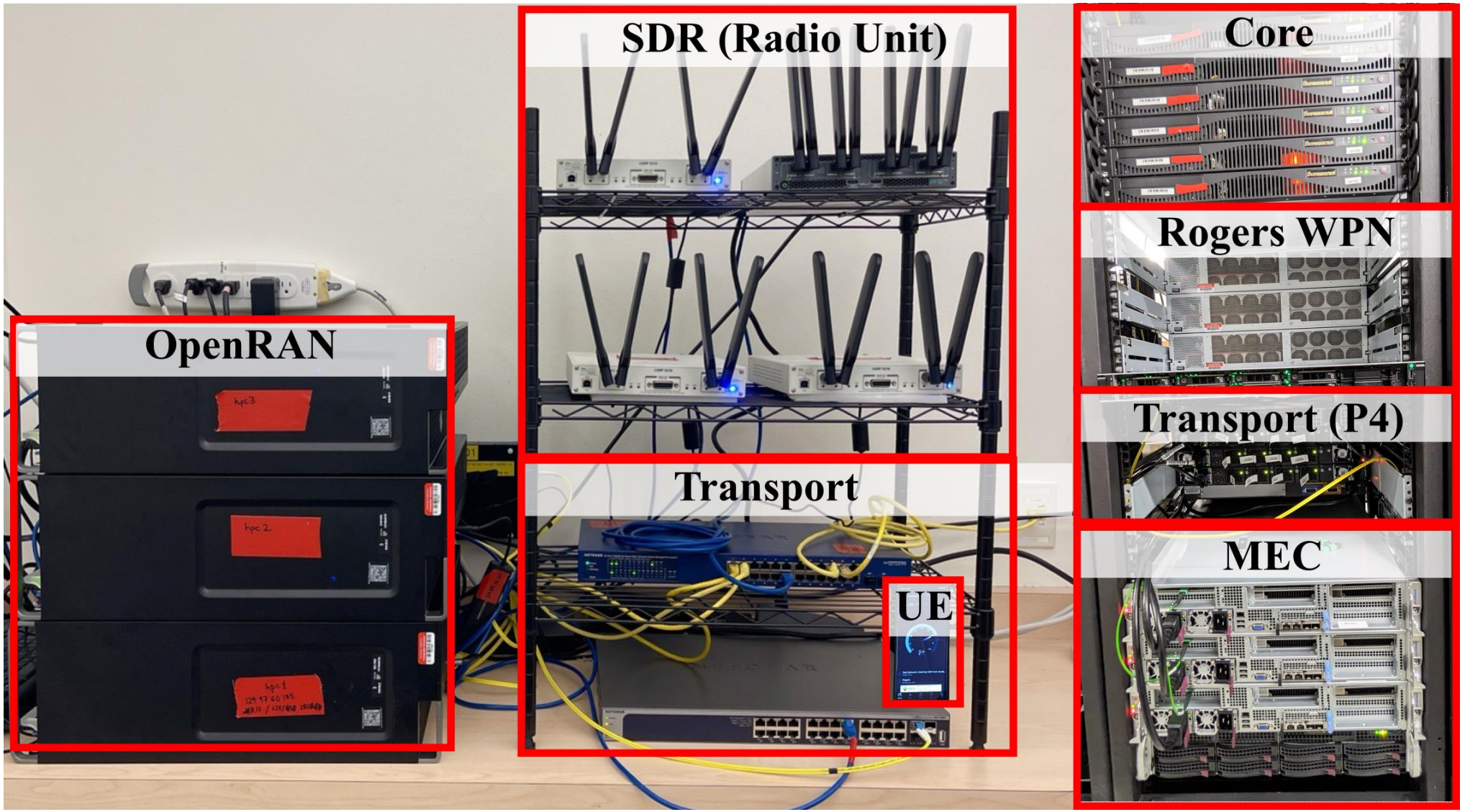
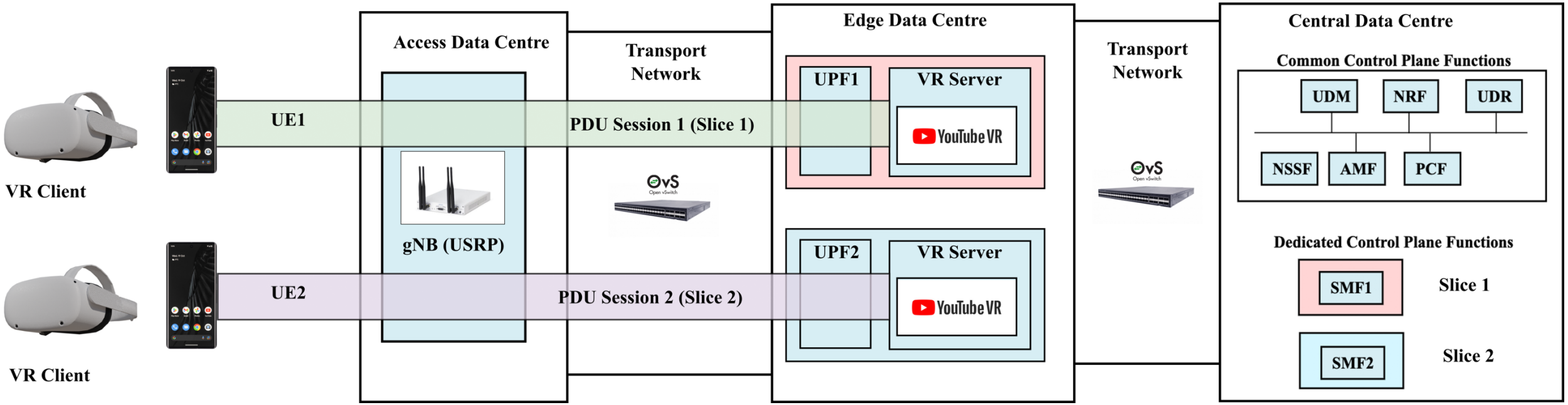
Network Slicing Testbed at UW



Use-case: VR Streaming



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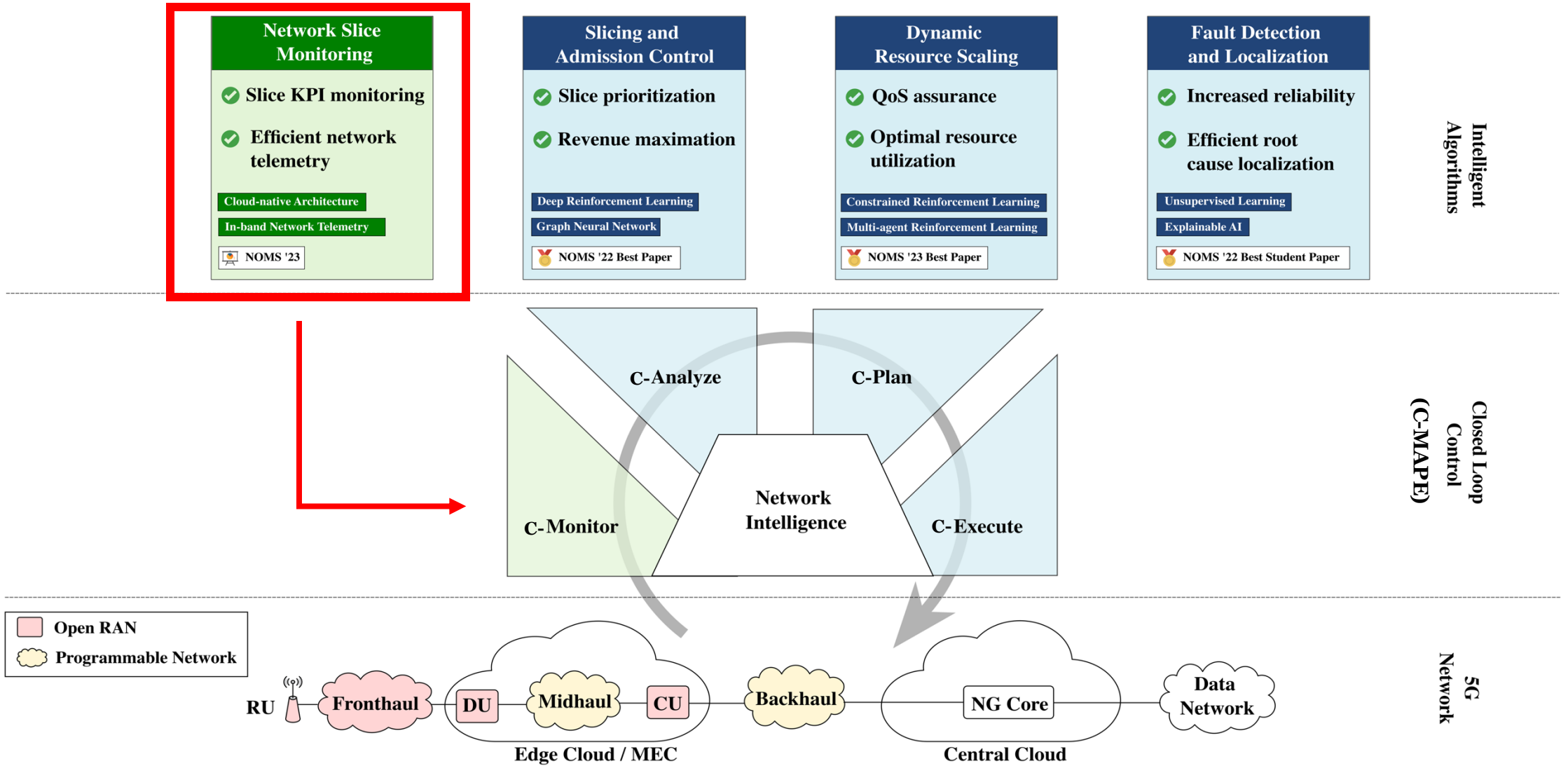
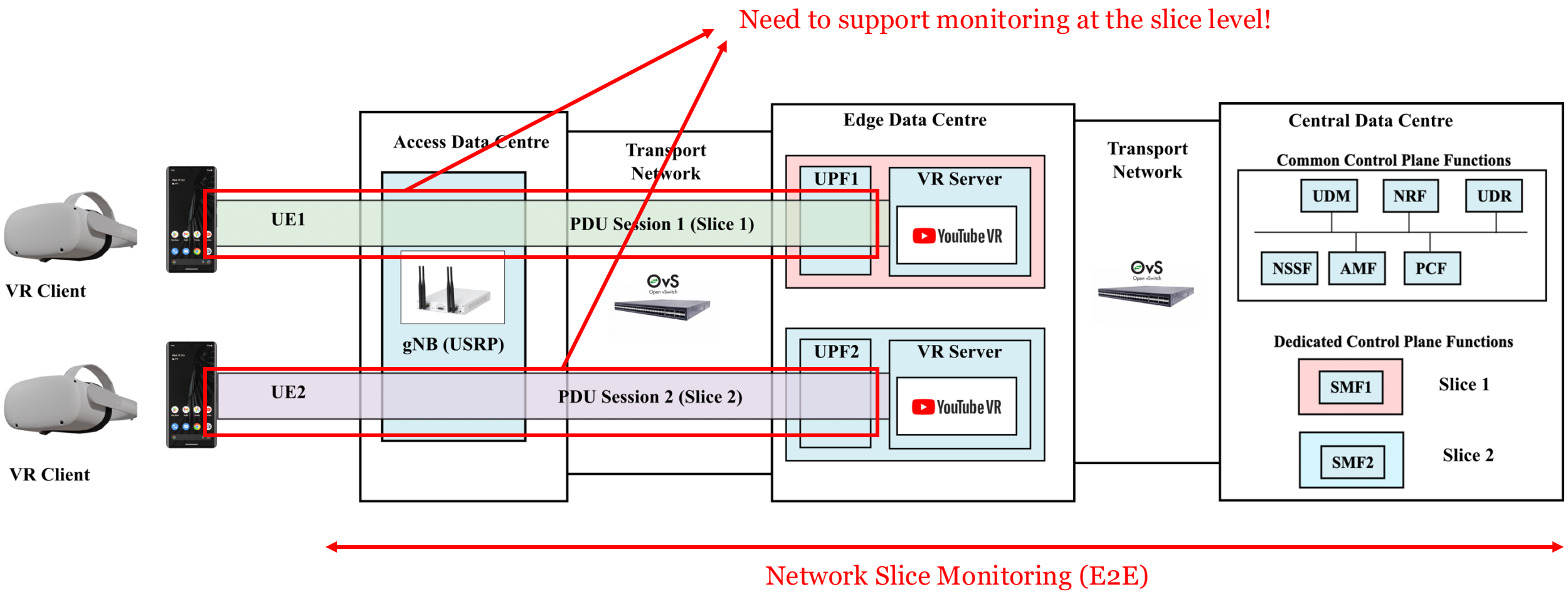
NETWORK SLICE MONITORING

Network Slice Monitoring



Network Slice Monitoring



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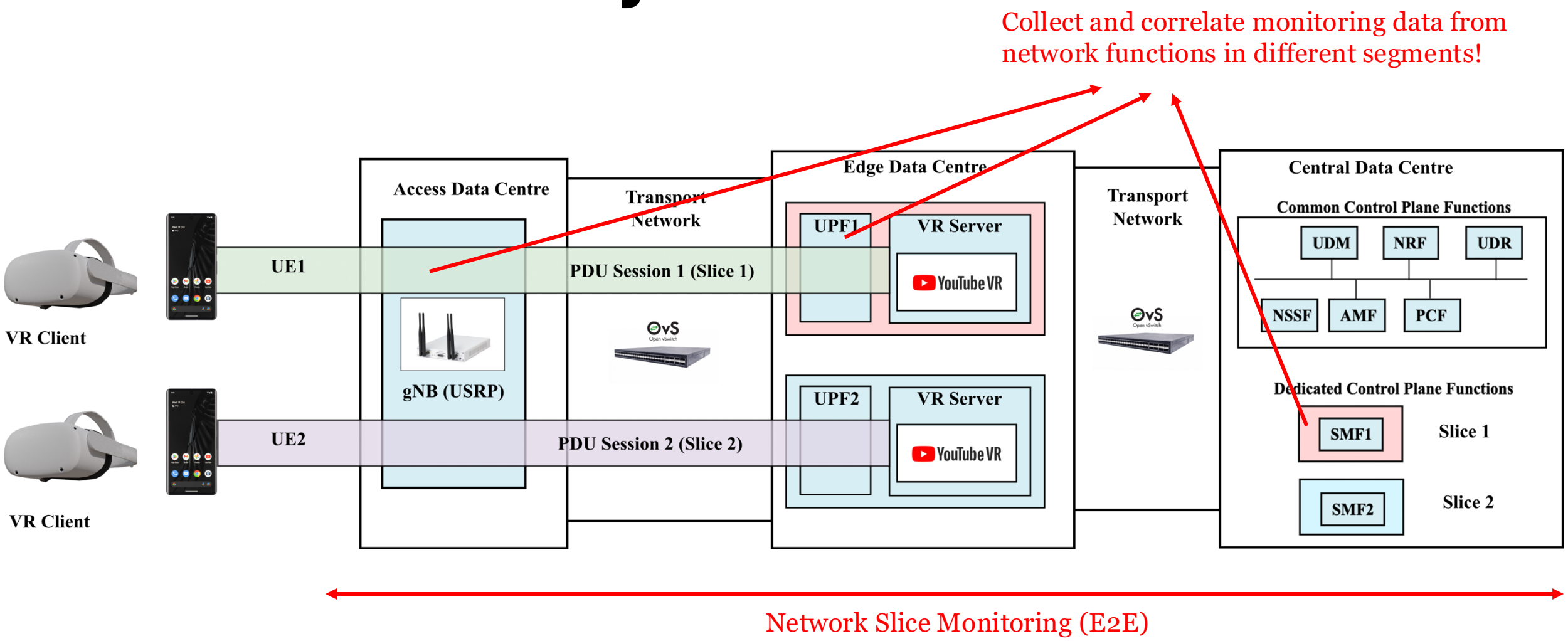
Network Slice Monitoring



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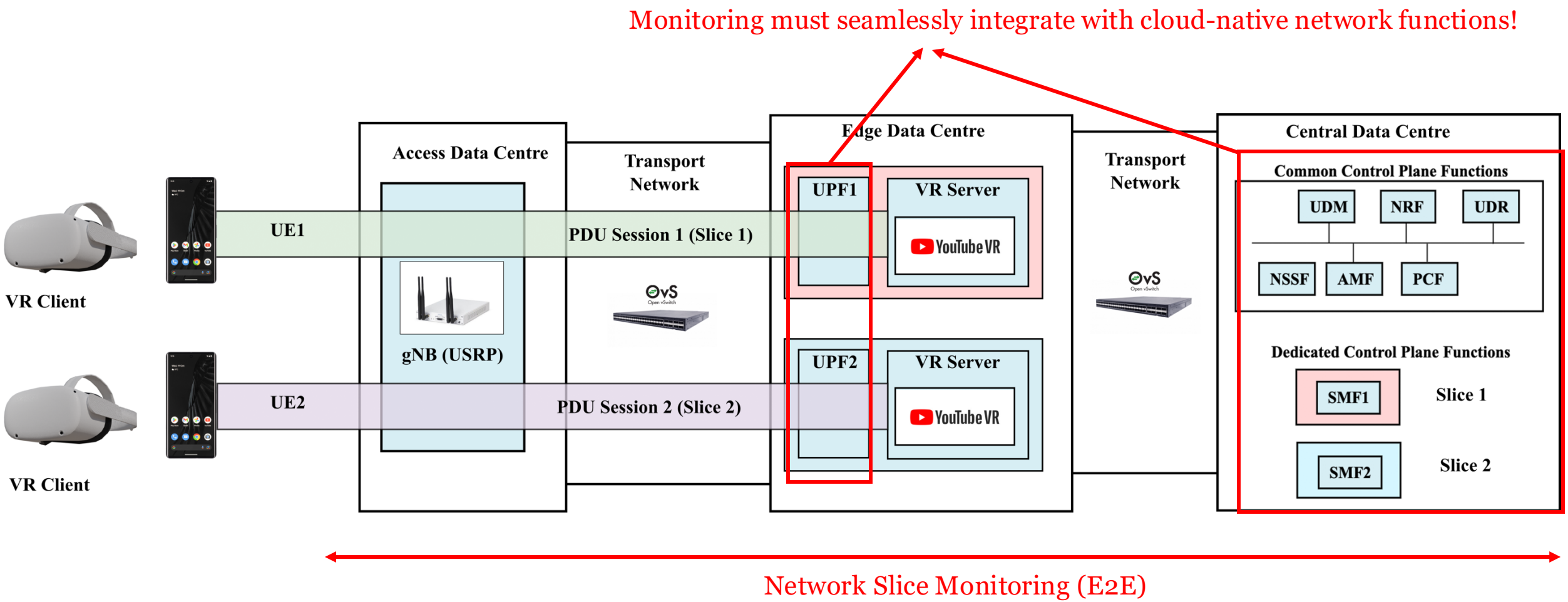
Network Slice Monitoring



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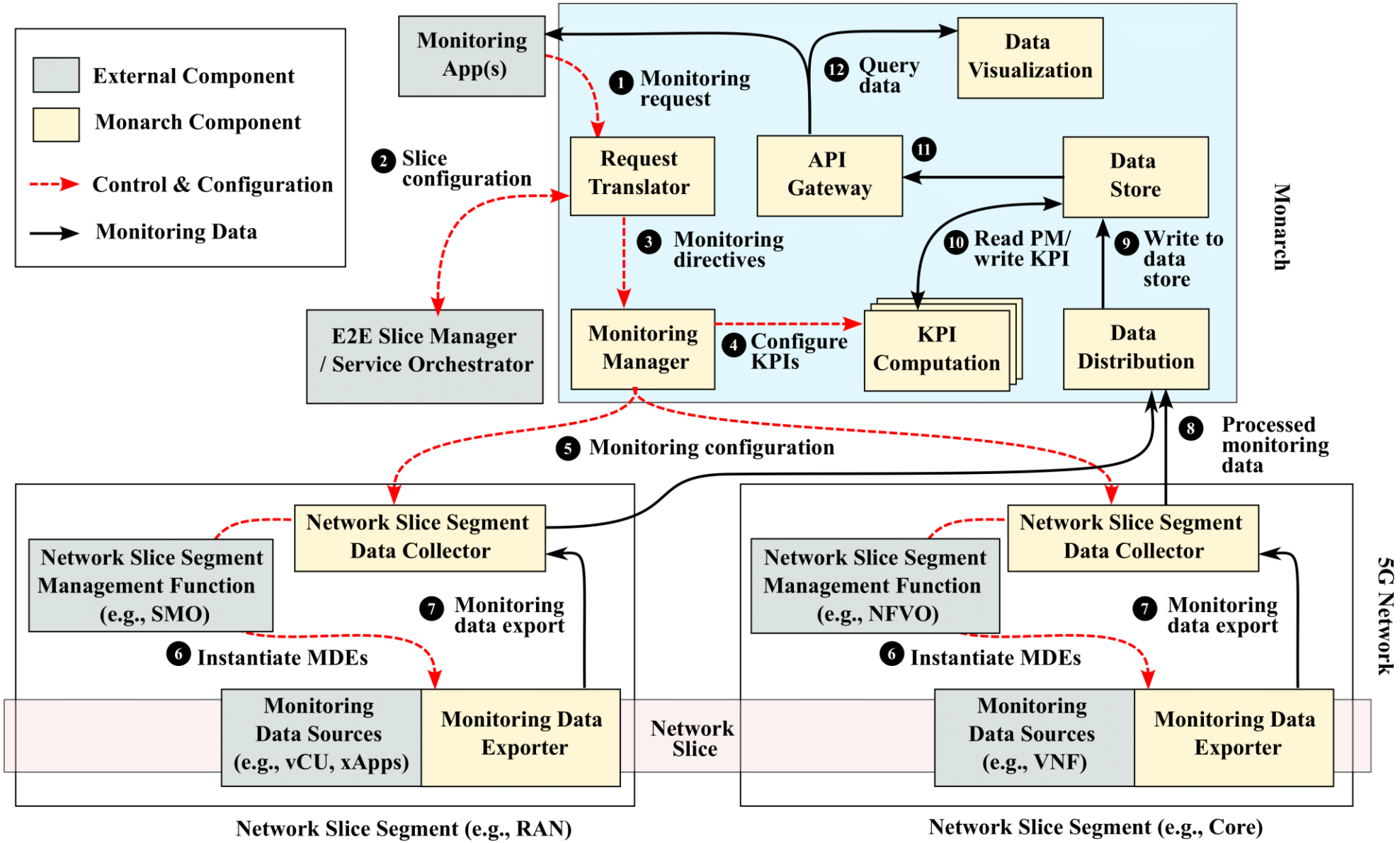
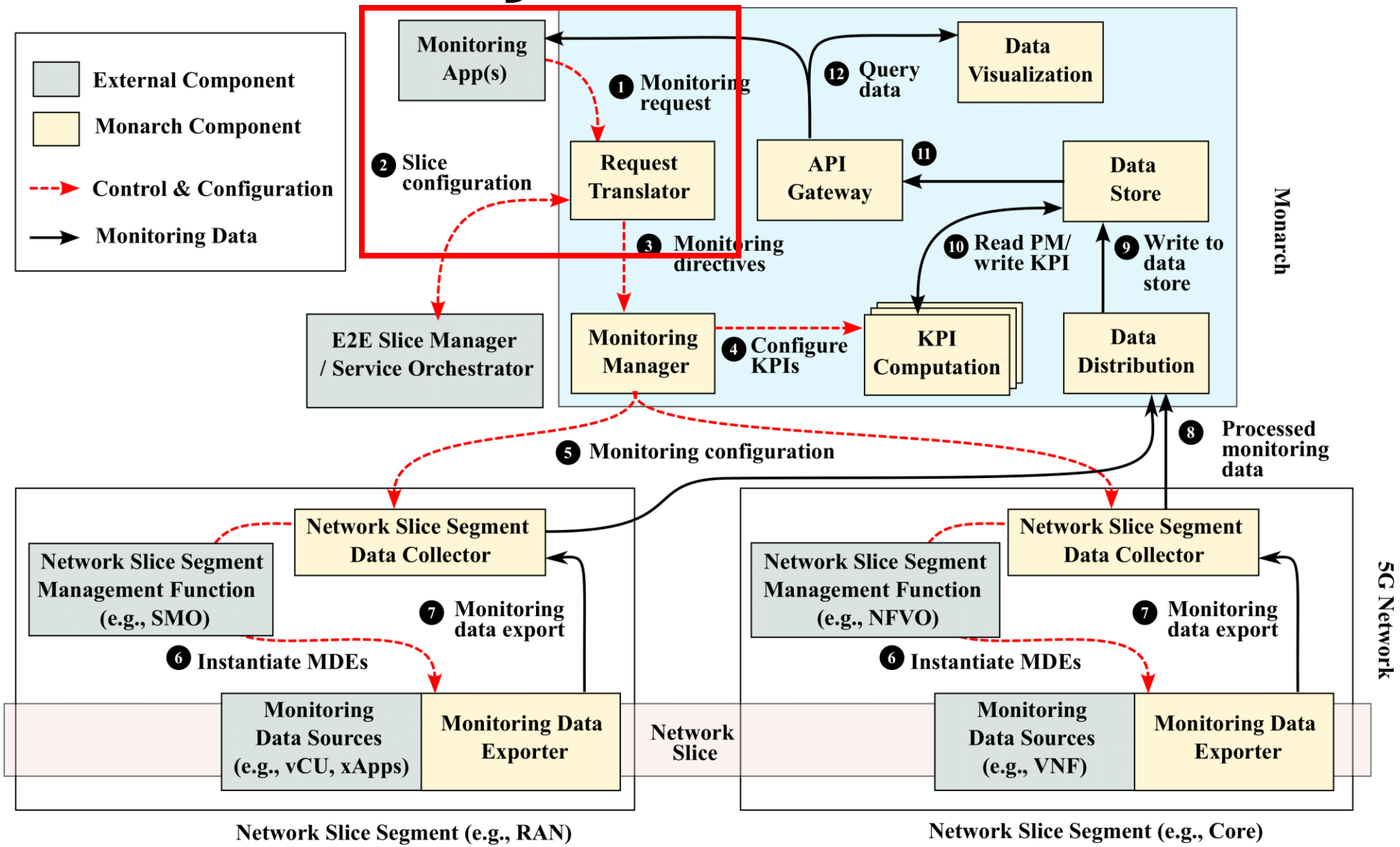
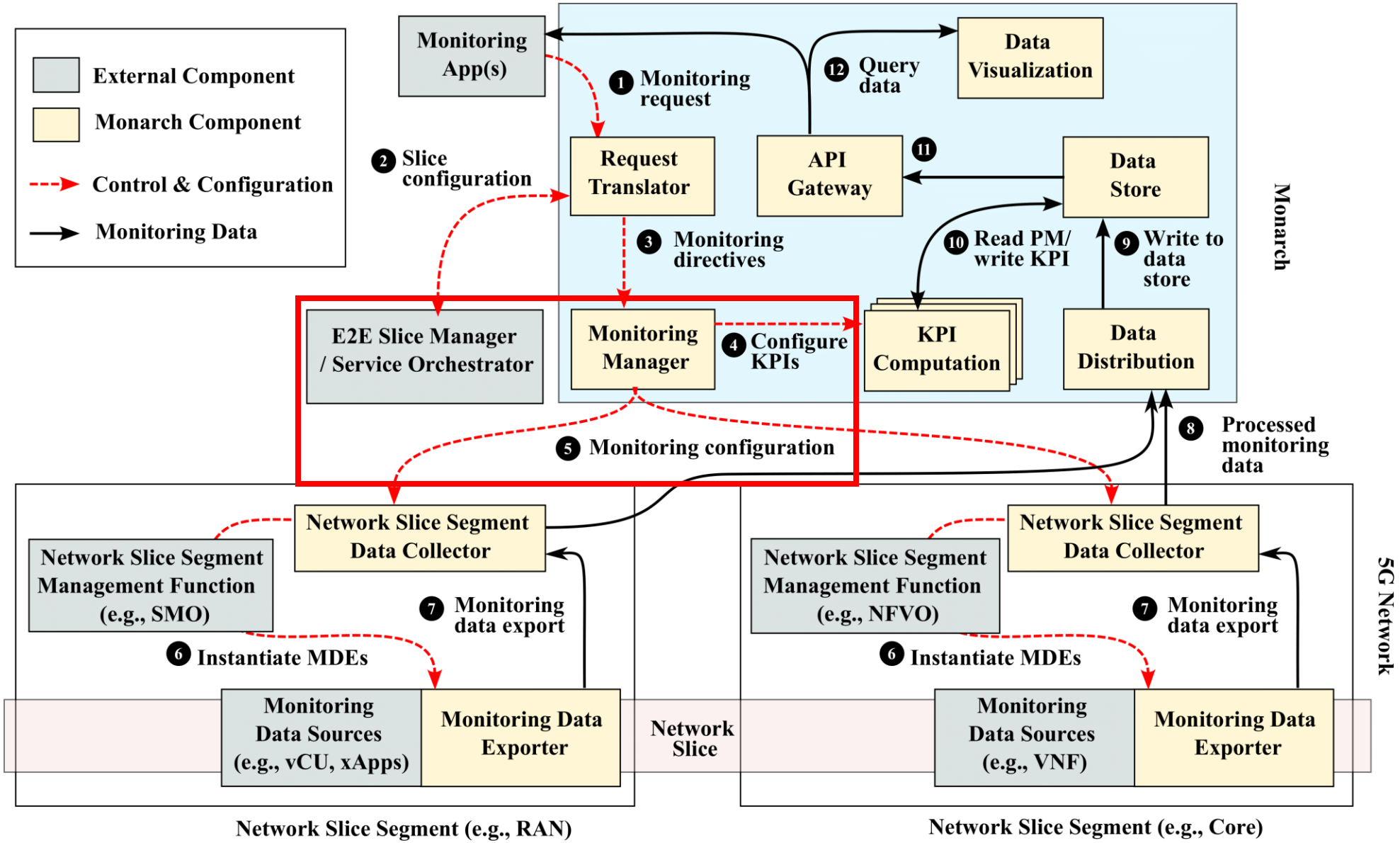
Network Slice Monitoring with Monarch



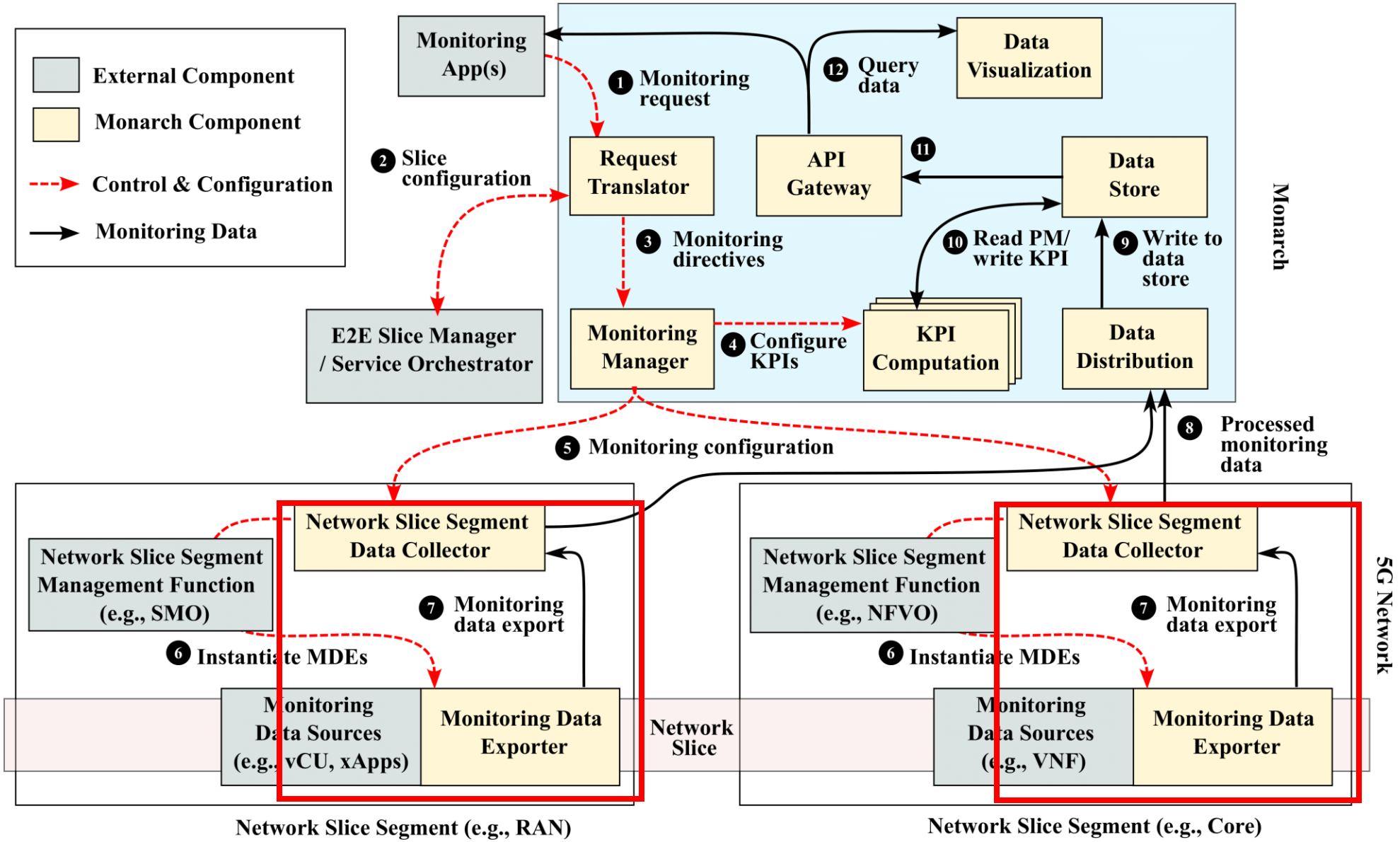
Network Slice Monitoring with Monarch



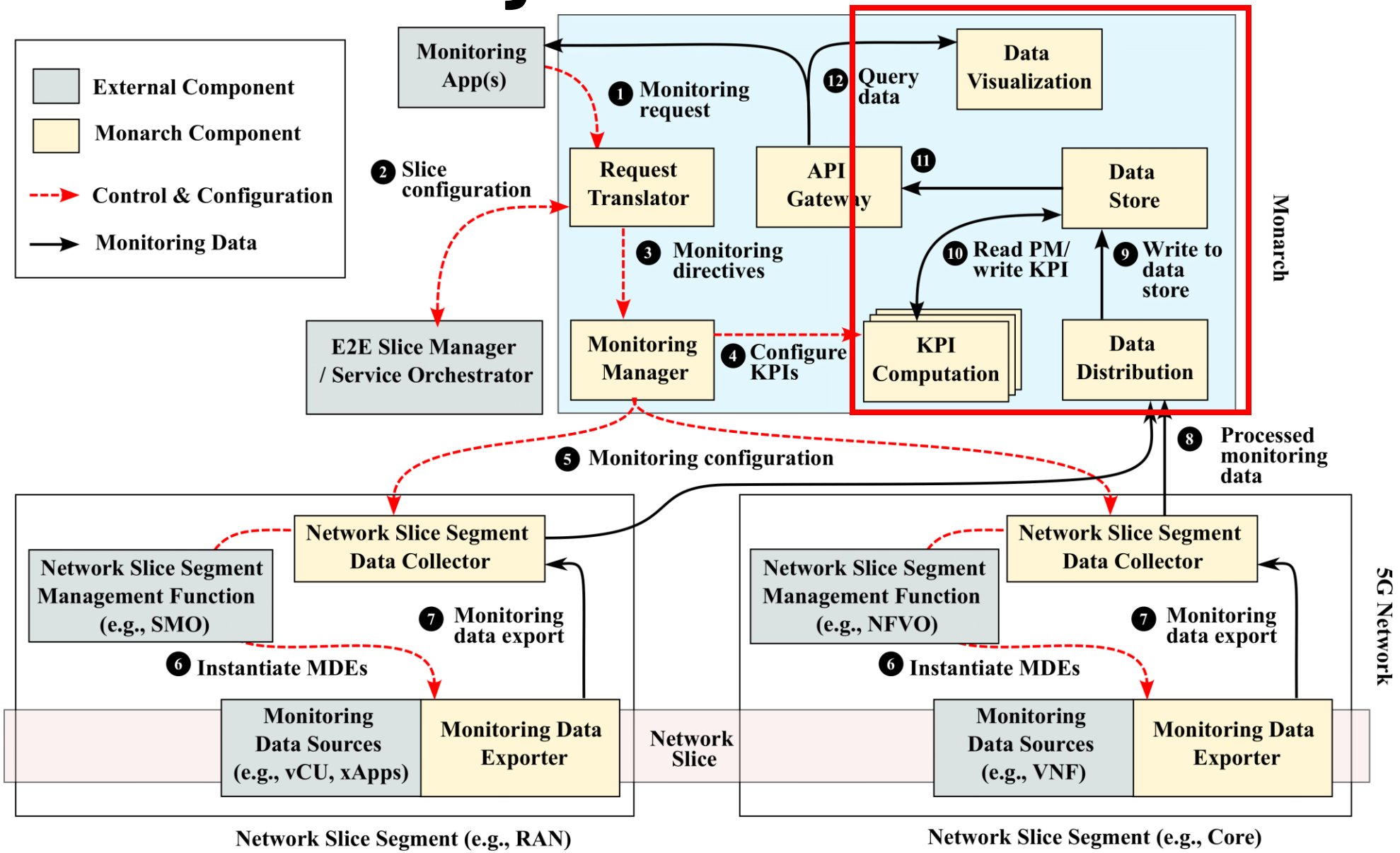
Network Slice Monitoring with Monarch



Network Slice Monitoring with Monarch



Network Slice Monitoring with Monarch



USE-CASE: VR STREAMING

DYNAMIC RESOURCE SCALING

Dynamic Resource Scaling (1/2)

DRS: Main Idea

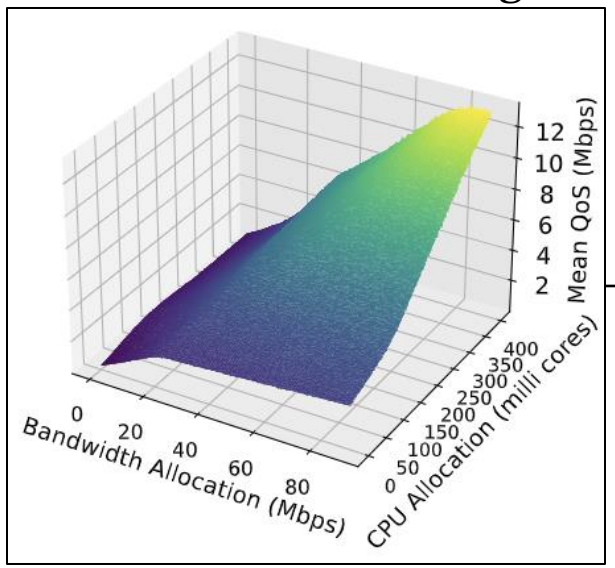
Scaling resources allocated to slices based on predicted traffic

DRS: Objective

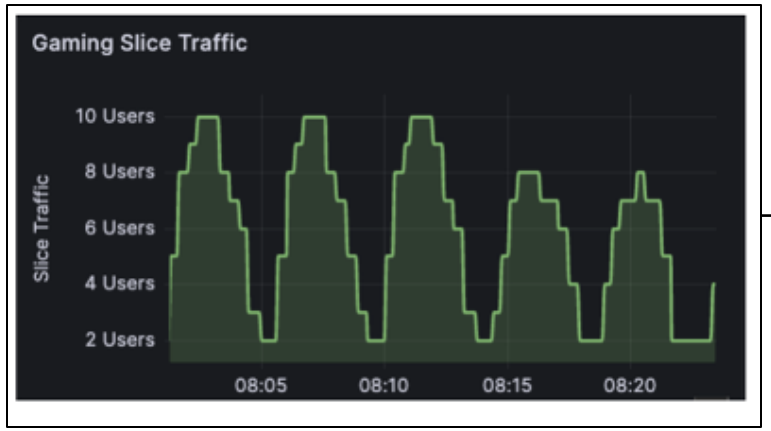
- Minimize resource allocation
- Maintain minimum QoS threshold

Dynamic Resource Scaling (2/2)

Network Modelling



Slice Traffic Forecast



Resource Scaling Algorithm

Algorithm 1 Resource Allocation Algorithm

Input: Traffic $\boldsymbol{x}^s_{\tau_i}$, Network Model $f^s_{QoS}(\boldsymbol{x}^s_{\tau_i}, \boldsymbol{r}^s_{\tau_i})$, QoS threshold q^s_{thresh}, QoS degradation threshold β^s_{thresh}, $\tau_{1,max}, \tau_{2,max}, \alpha_1, \alpha_2, \alpha_3, \epsilon_1, \epsilon_2$

Output: Optimal resource allocation vector $\boldsymbol{r}^s_{\tau_i}$

Initialize $\boldsymbol{\lambda}, \boldsymbol{\mu}$, LB $= 0$, UB $= \infty$, $\tau_1 = 0, \tau_2 = 0$
while $\frac{\text{UB}-\text{LB}}{\text{UB}} > \epsilon_1$ **or** $\tau_1 < \tau_{1,max}$ **do**
  $\mathbf{r} \leftarrow \texttt{Gridsearch}(\boldsymbol{x}^s_{\tau_i}, f_{QoS}(\boldsymbol{x}^s_{\tau_i}, \mathbf{r}))$
  while $|\nabla_r \hat{\mathcal{L}}| > \epsilon_2$ **or** $\tau_2 < \tau_{2,max}$ **do**
    $\mathbf{r} \leftarrow [\mathbf{r} - \alpha_1 \nabla_r \hat{\mathcal{L}}]^+$
    $\tau_2 \leftarrow \tau_2 + 1$
  end while
  $\lambda_s \leftarrow [\lambda_s + \alpha_2(\beta^s - \beta^s_{thresh})]^+, \forall s$
  $\mu_k \leftarrow [\mu_k + \alpha_3(\sum_{s \in S} r^{s,k} - R^k)]^+, \forall k$
  LB $= \max(\text{LB}, \mathcal{L}(\mathbf{r}, \boldsymbol{\mu}, \boldsymbol{\lambda}))$
  UB $= \min(\text{UB}, \sum_{s \in S} \eta^\intercal \mathbf{r}^s)$
  $\tau_1 \leftarrow \tau_1 + 1$
end while
return r

Resource Allocation →

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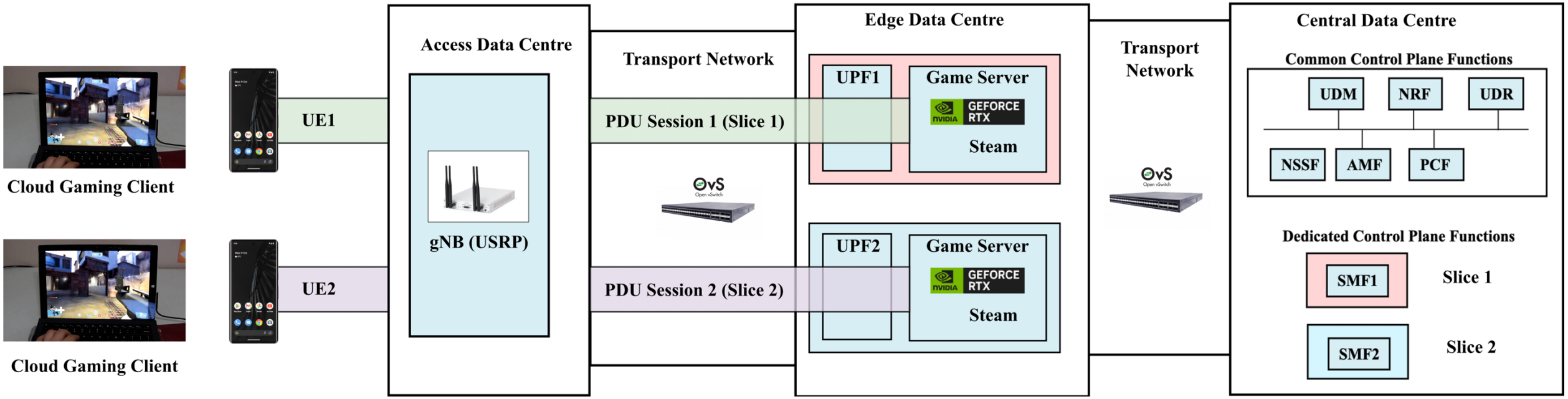
USE-CASE: CLOUD GAMING

Use-case: Cloud Gaming



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