NetAssistant: Dialogue Based Network Diagnosis in Data Center Networks

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Motivation

NetAssistant Design

Deployment & Gain

Lessons & Future Work

Motivation

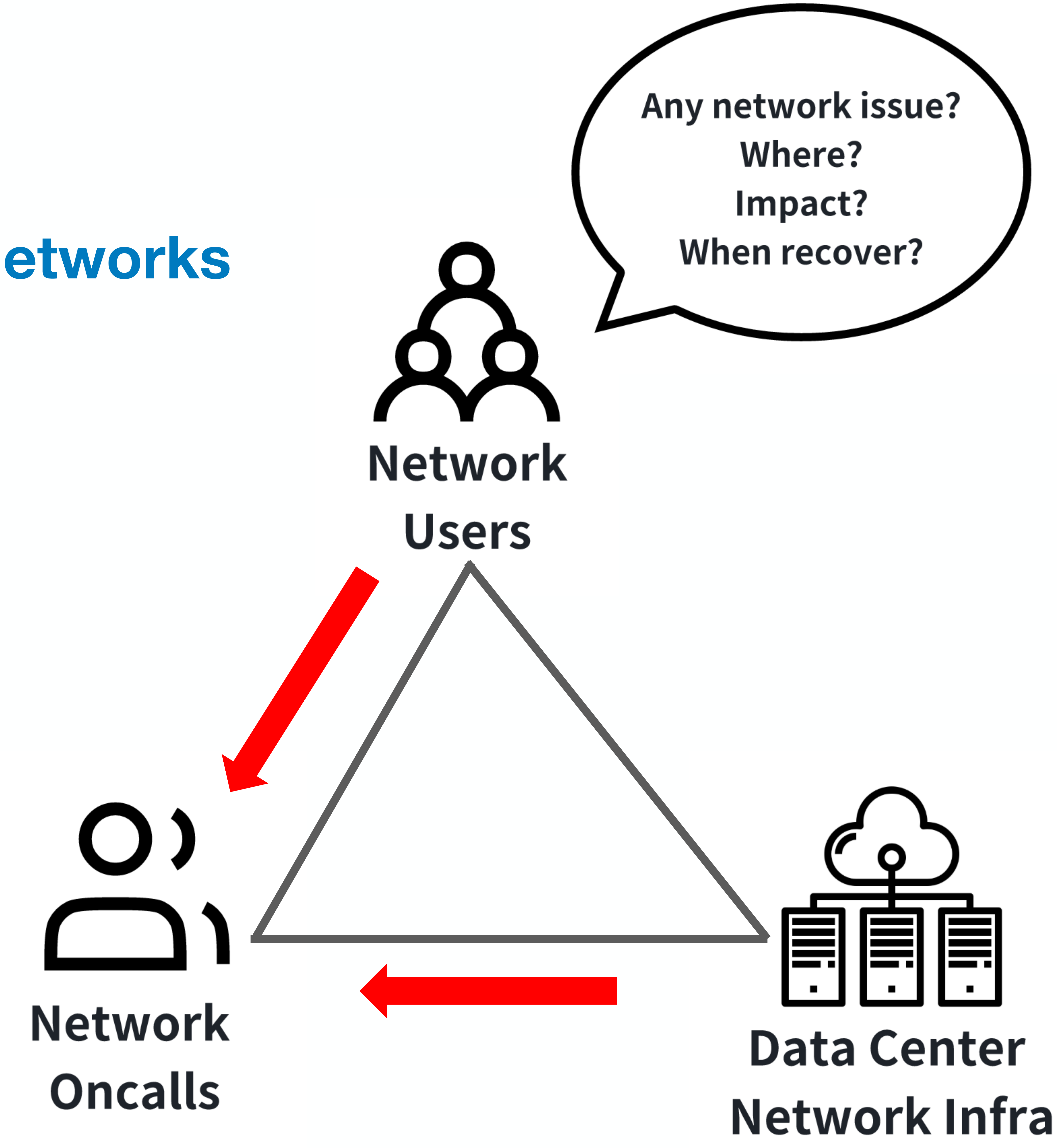
High visibility is important in datacenter networks

Especially for network users

Network oncalls handler requests/tickets

Time consuming and labor intensive
Monitoring data, incidents records

There is a gap!



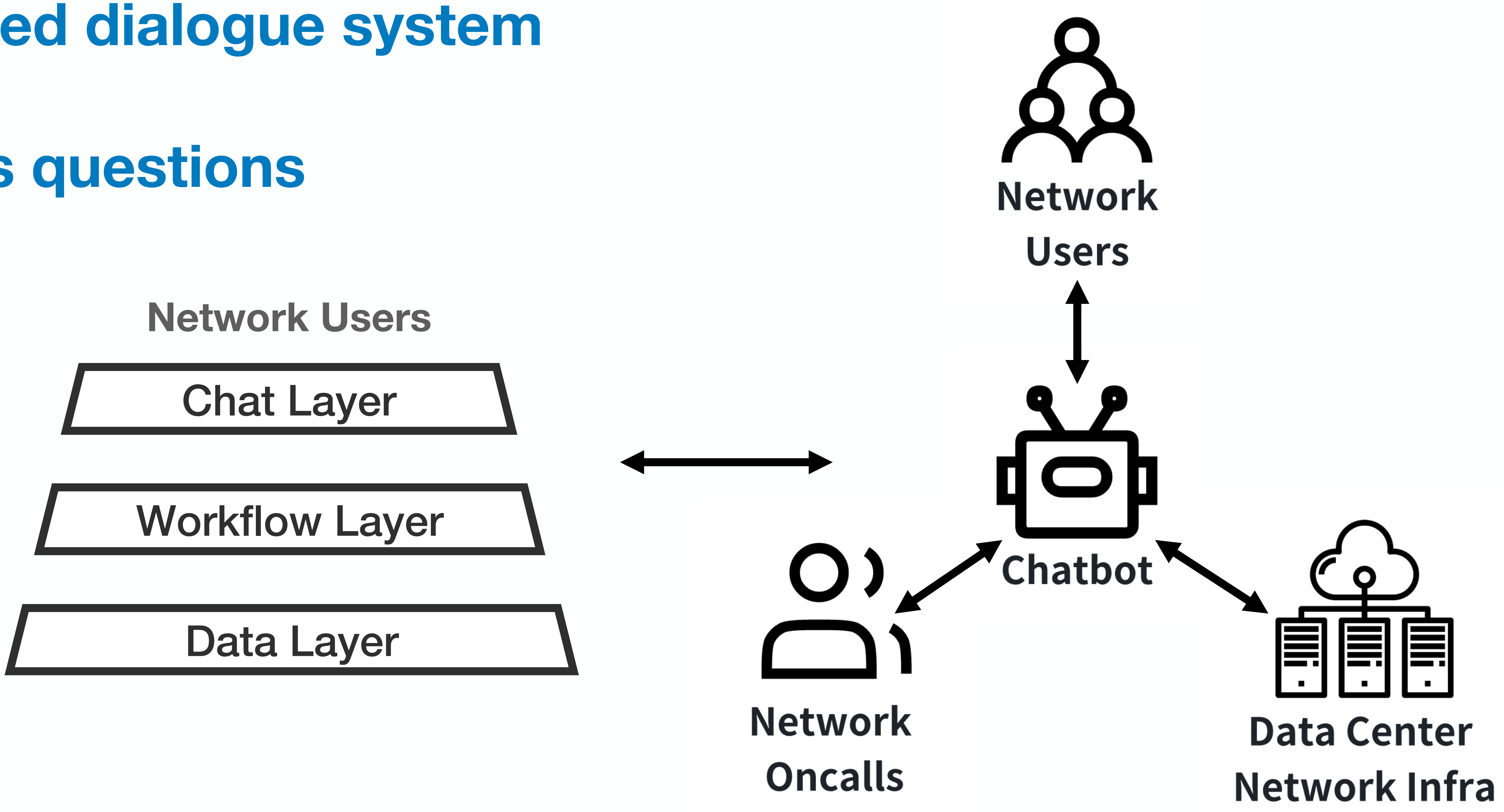
NetAssistant Design

Our Idea: Leverage a task-oriented dialogue system

Automatically answers diagnosis questions

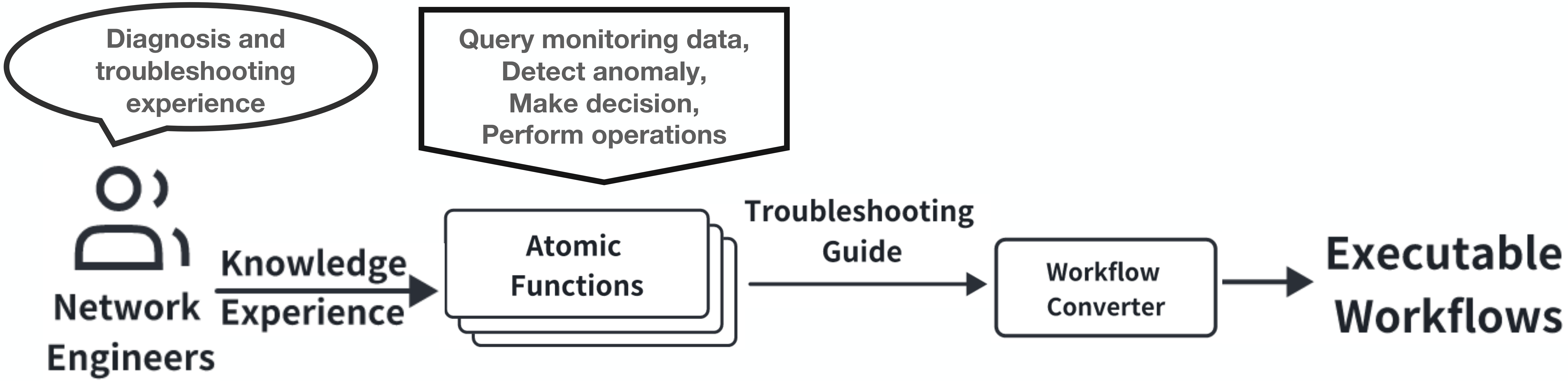
Three layers of abstraction

1. Chat service
   - Dialogue Engine
2. Diagnosis workflows
   - Workflow Engine
3. Retrieval of monitoring data
   - Data Engine



NetAssistant Design

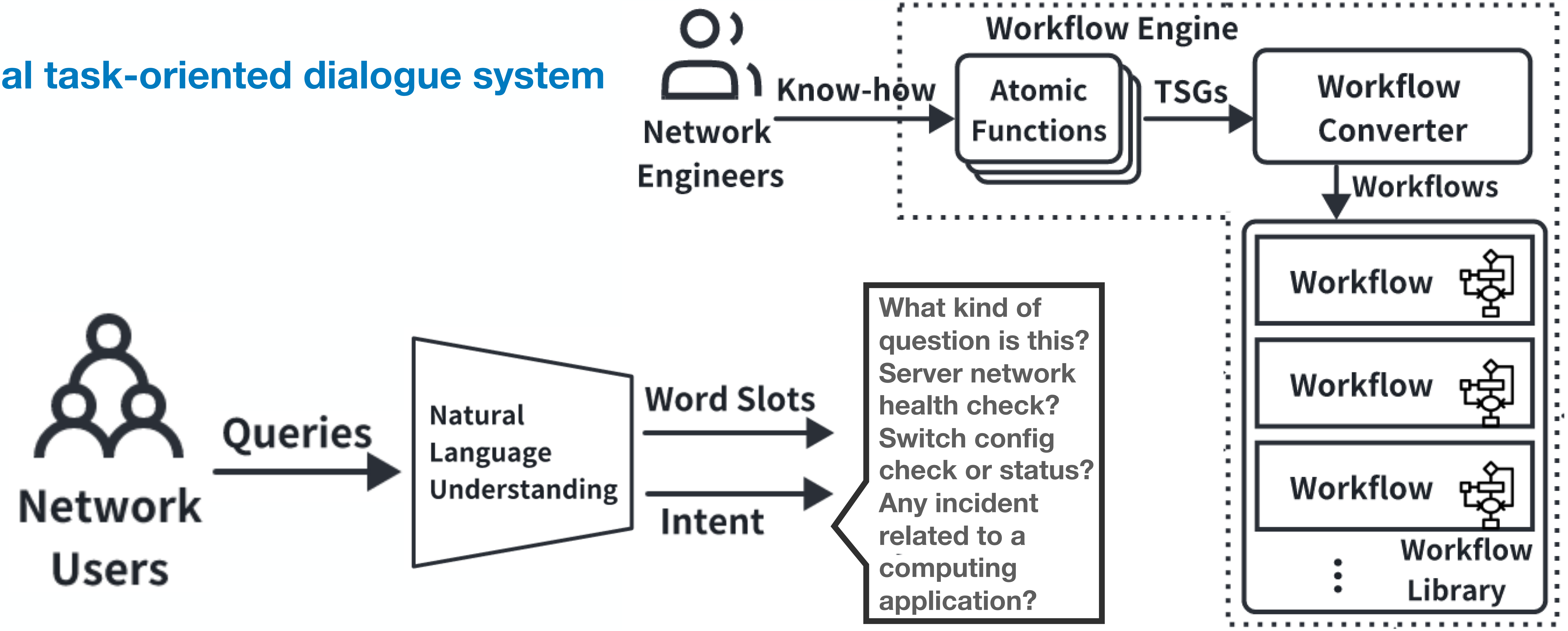
Workflow Engine:



NetAssistant Design

Dialogue Engine:

A typical task-oriented dialogue system



What kind of question is this? Server network health check? Switch config check or status? Any incident related to a computing application?

NetAssistant Design

Data Engine:

Performance bottleneck

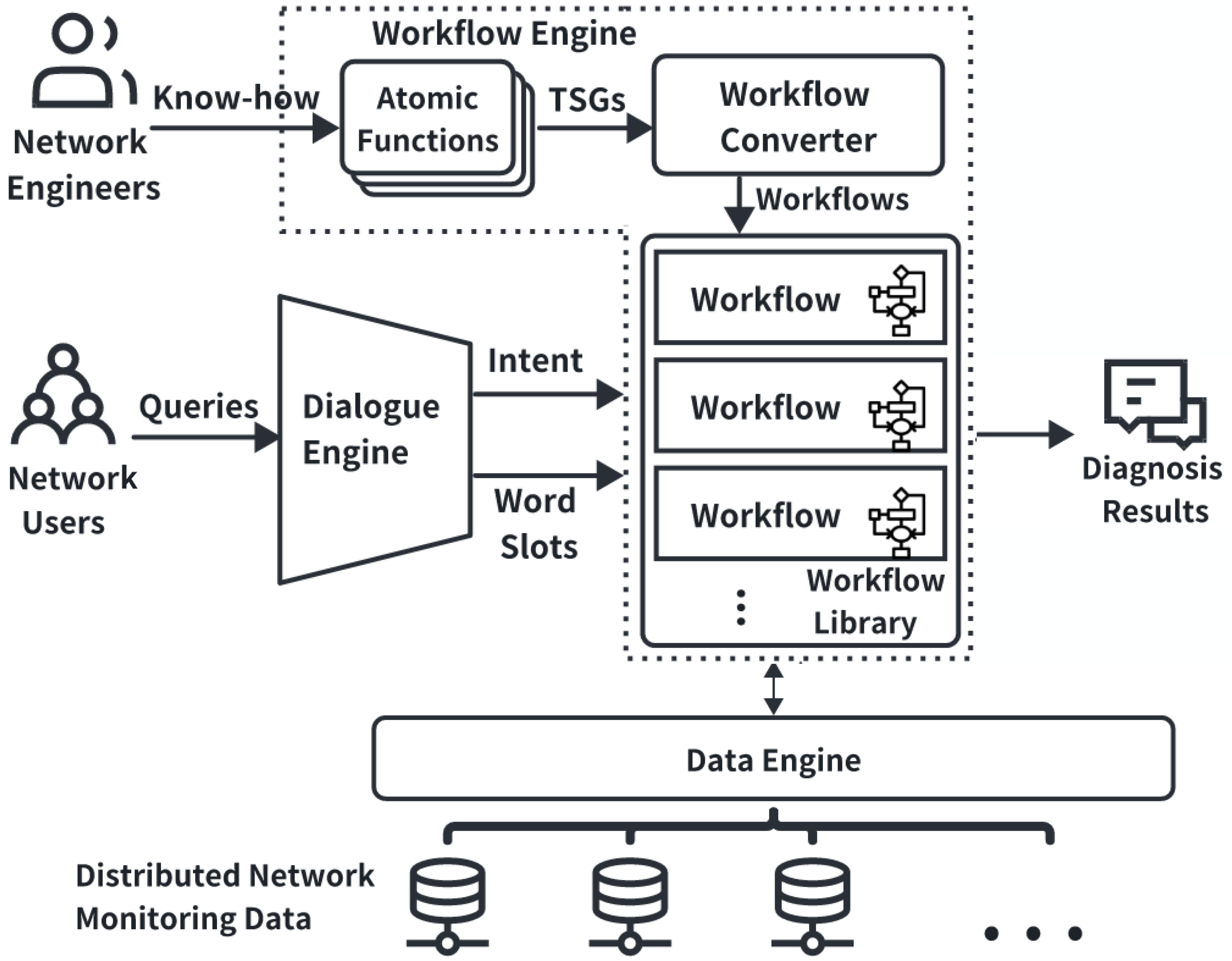
- Query monitoring data
- E.g., sFlow for 100 links
- E.g., syslog for 1000 switches

Our Idea:

Only anomalies/jitters are important

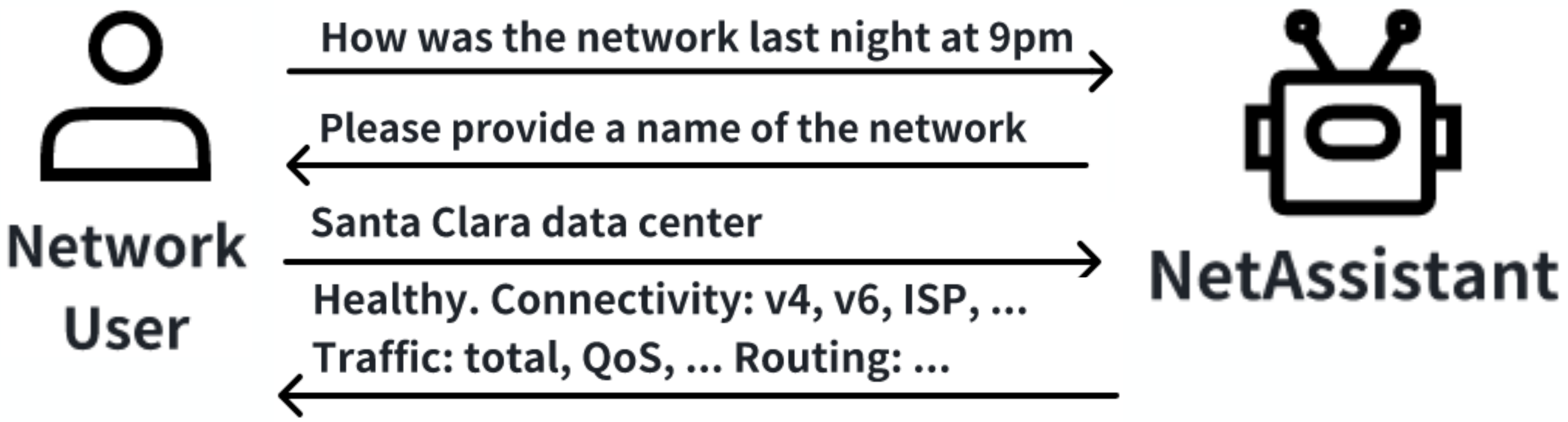
We combine:

- Reactive/on-demand querying
- Proactive alerting



NetAssistant Design

Sample dialogues between NetAssistant and the users:



Network User
How was the network last night at 9pm
Please provide a name of the network
Santa Clara data center
Healthy. Connectivity: v4, v6, ISP, ...
Traffic: total, QoS, ... Routing: ...
NetAssistant

Deployment & Gain

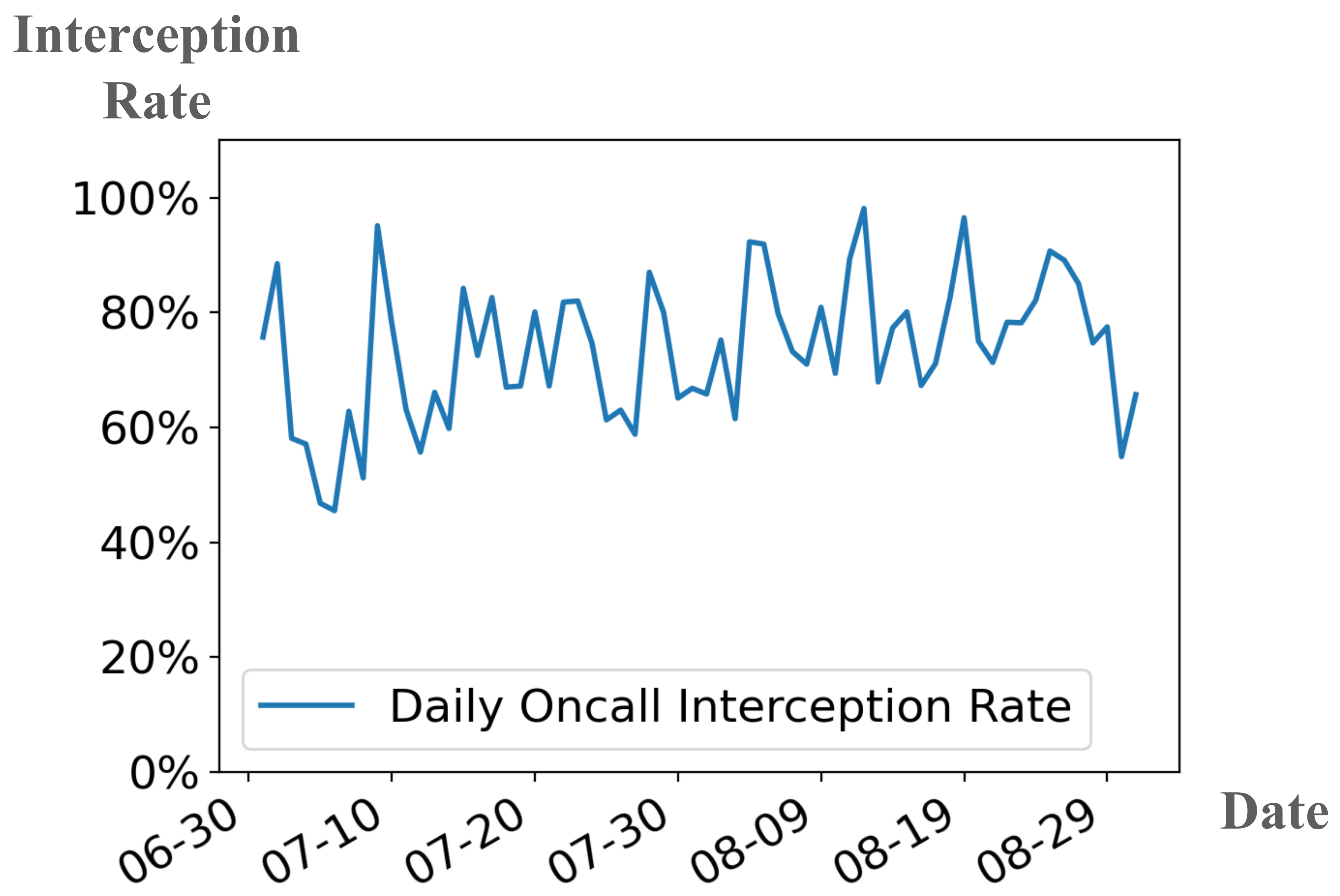
First version was launched in April 2020

- Starting with only 2 workflows, now 100+
- Iterate on technology and functionality every few weeks
- Now ~200 uses per day

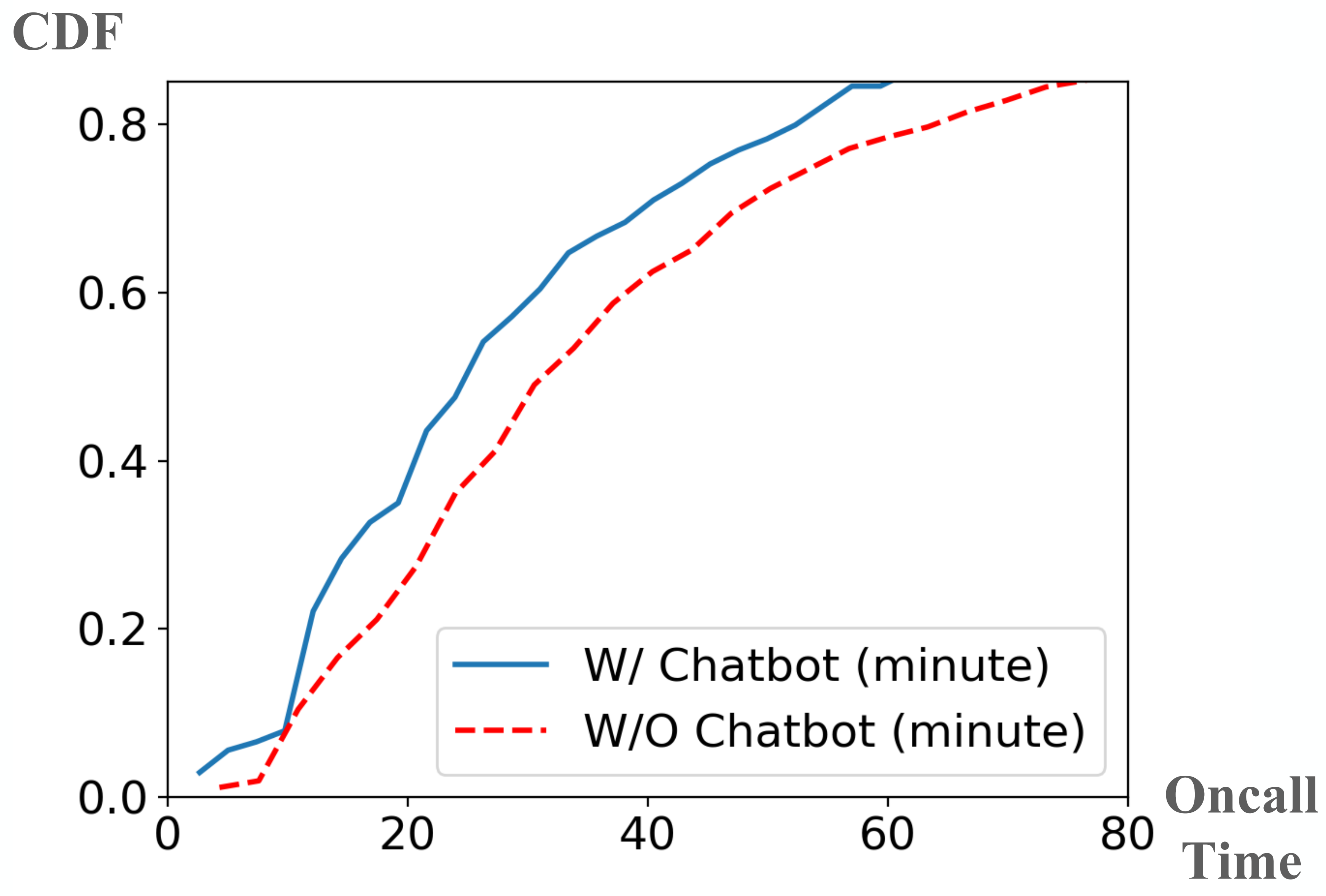
What is the gain of this project?

- Save human labor time
- Directly intercept oncalls
- Reduce oncall duration time

Deployment & Gain



Intercepted a considerable proportion of oncalls in 2023



Reduce oncall duration time

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Lessons & Future Work

Lessons:

- Earn user trust
- FN is more harmful than FP
- Empowering our users

Future work:

- Explore the potential of LLM in AIOps
- Challenges:

  Understanding diagnosis logic

  Processing real time monitoring data

THANKS

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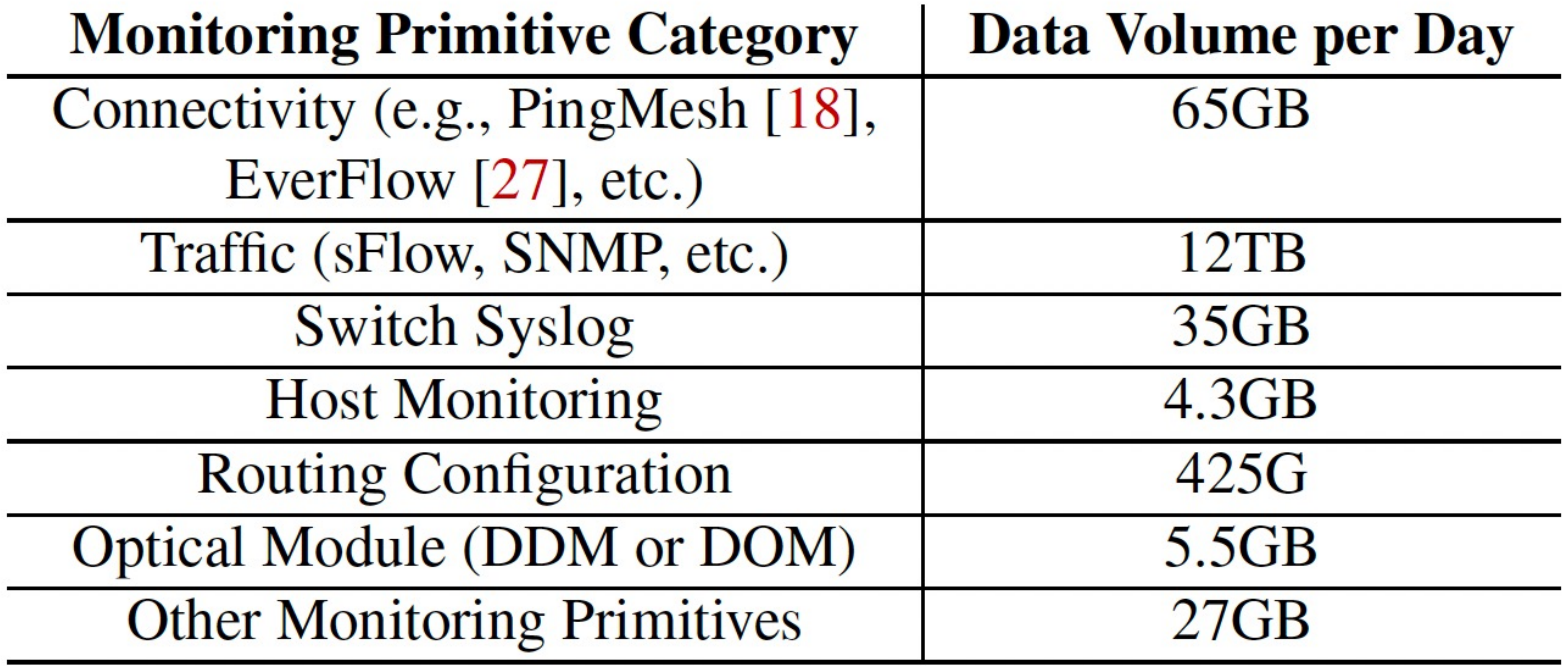
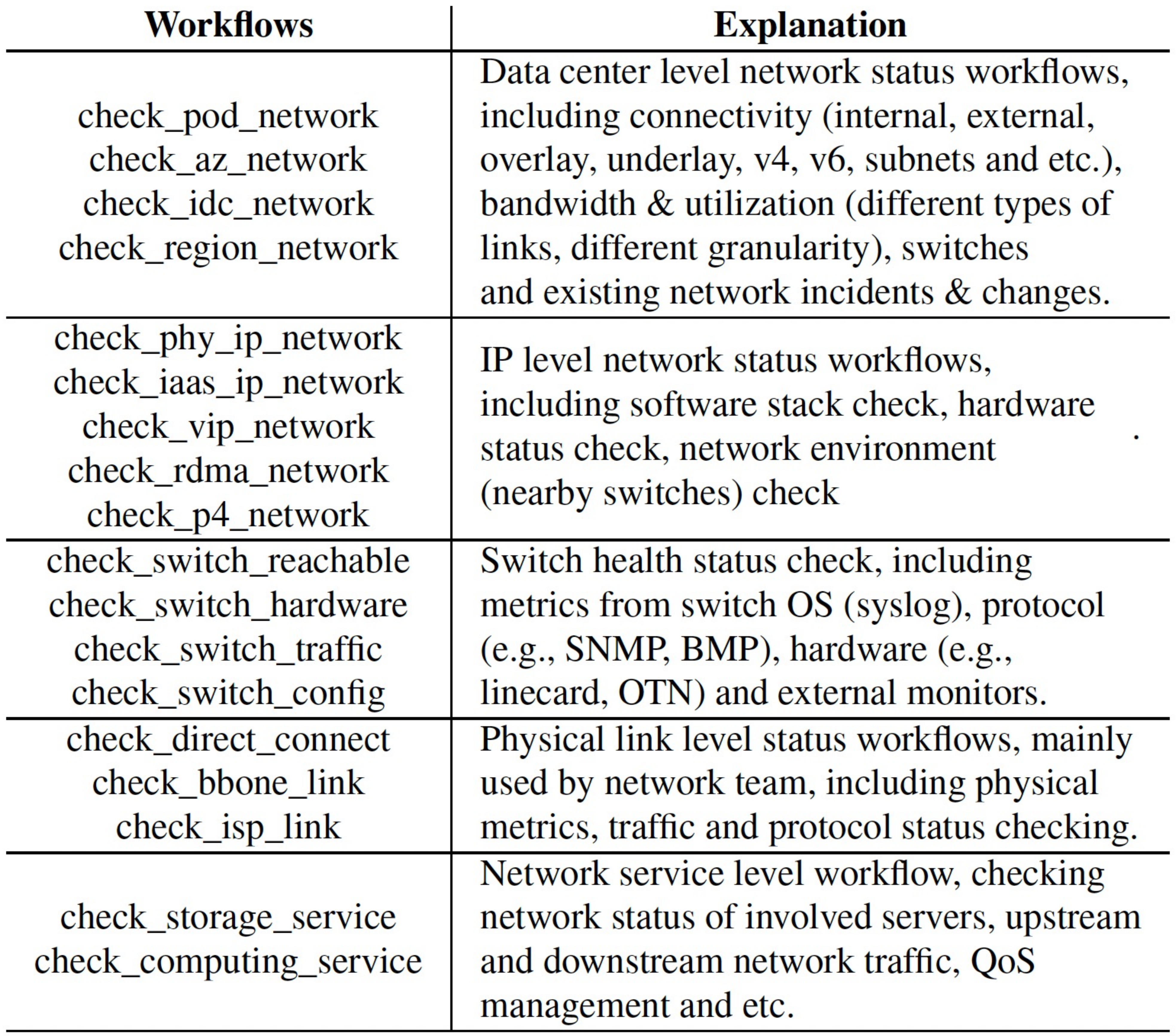
Appendix



Monitoring Primitive Category	Data Volume per Day
Connectivity (e.g., PingMesh [18], EverFlow [27], etc.)	65GB
Traffic (sFlow, SNMP, etc.)	12TB
Switch Syslog	35GB
Host Monitoring	4.3GB
Routing Configuration	425G
Optical Module (DDM or DOM)	5.5GB
Other Monitoring Primitives	27GB

Table 3: Monitoring primitives and data volume

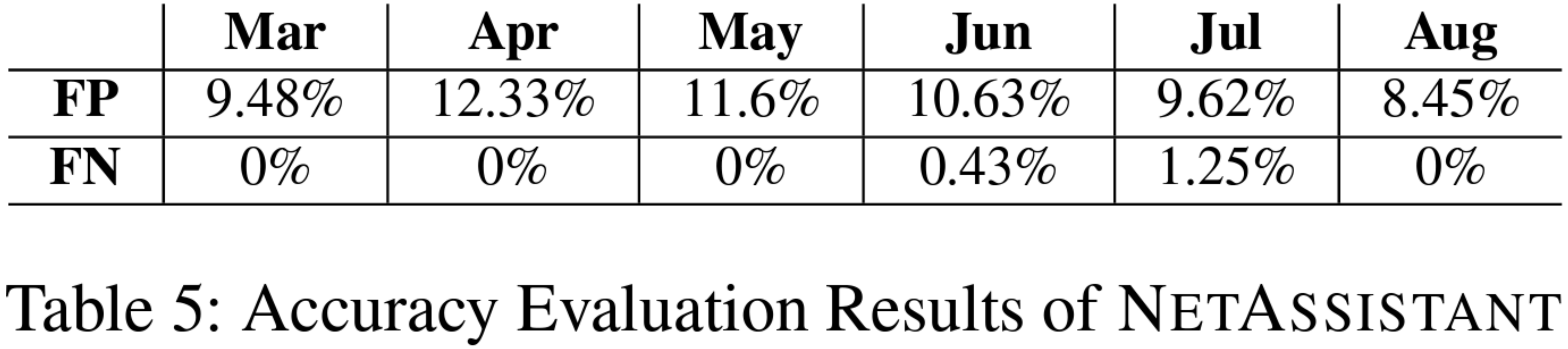
Appendix



Workflows	Explanation
check_pod_network check_az_network check_idc_network check_region_network	Data center level network status workflows, including connectivity (internal, external, overlay, underlay, v4, v6, subnets and etc.), bandwidth & utilization (different types of links, different granularity), switches and existing network incidents & changes.
check_phy_ip_network check_iaas_ip_network check_vip_network check_rdma_network check_p4_network	IP level network status workflows, including software stack check, hardware status check, network environment (nearby switches) check
check_switch_reachable check_switch_hardware check_switch_traffic check_switch_config	Switch health status check, including metrics from switch OS (syslog), protocol (e.g., SNMP, BMP), hardware (e.g., linecard, OTN) and external monitors.
check_direct_connect check_bbone_link check_isp_link	Physical link level status workflows, mainly used by network team, including physical metrics, traffic and protocol status checking.
check_storage_service check_computing_service	Network service level workflow, checking network status of involved servers, upstream and downstream network traffic, QoS management and etc.

Table 4: Commonly used workflows

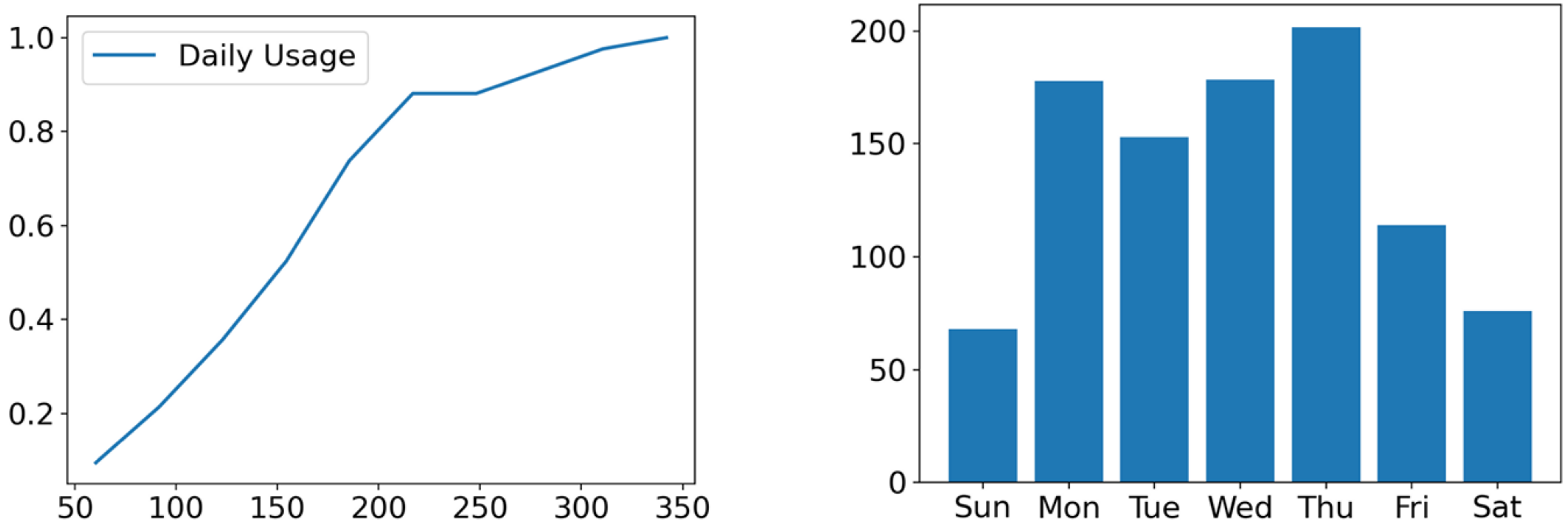
Appendix



	Mar	Apr	May	Jun	Jul	Aug
FP	9.48%	12.33%	11.6%	10.63%	9.62%	8.45%
FN	0%	0%	0%	0.43%	1.25%	0%

Table 5: Accuracy Evaluation Results of NETASSISTANT

Appendix



(a) Daily Oncall Usage for July and August in 2023 (CDF)

(b) The 50th Percentile Usage by Day of the Week

Figure 8: Daily Usage Results of NETASSISTANT