ProxyStore: a Data Fabric for Parsl and FuncX

Greg Pauloski

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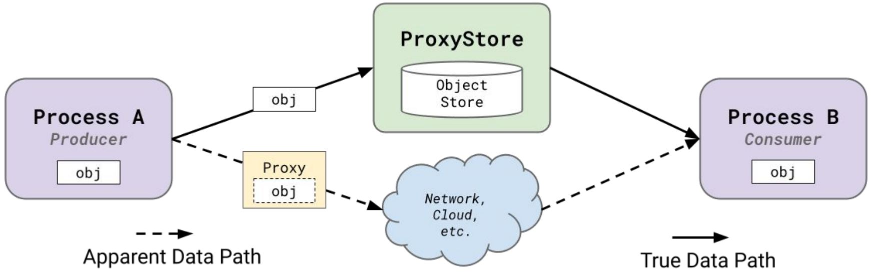
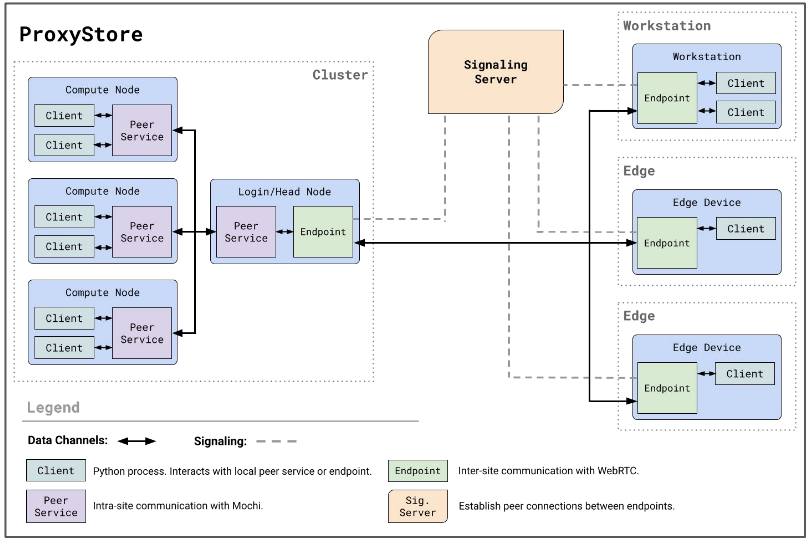
Proxies + Object Stores = ProxyStore





Client	Python process. Interacts with local peer service or endpoint.	Endpoint	Inter-site communication with WebRTC.
Peer Service	Intra-site communication with Mochi.	Sig. Server	Establish peer connections between endpoints.

Decouple Object Communication from System Design →

1. **Compatibility**
2. **Productivity**
3. **Performance**

Proxy Objects

- Transparently wrap ***target*** objects
- Acts like a wide-area reference
- Initialized with a ***factory***
- Just-in-time ***resolution***

```python
import numpy as np
from proxystore.proxy import Proxy

x = np.array([1, 2, 3])

# Proxy(Callable[[], T]) -> Proxy[T]
p = Proxy(lambda: x)

# A proxy is an instance of its wrapped object
assert isinstance(p, Proxy)
assert isinstance(p, np.ndarray)

# The proxy can do everything the numpy array can
assert np.array_equal(p, [1, 2, 3])
assert np.sum(p) == 6
y = x + p
assert np.array_equal(y, [2, 4, 6])
```

```python
import torch
from funcx.sdk.client import FuncXClient, FuncXExecutor
from proxystore.proxy import Proxy

def load_model() -> MyModel:
    state_dict = torch.load('/path/to/model')
    return MyModel().load_state_dict(state_dict)

def inference(model: MyModel) -> Result:
    ...

fx = FuncXExecutor(FuncXClient())

# Model will be lazily "resolved" once needed by inference()
# and no consumer-side code changes are needed
res = fx.submit(inference, Proxy(load_model), endpoint_id=...)
```

```python
def compute(obj: MyData) -> Result:
    # Computation ...
    return Result(...)
```

```python
def compute(obj: MyData | str) -> Result:
    if isinstance(obj, str):
        with open(obj) as f:
            obj = deserialize(f.read())

    # Computation ...
    return Result(...)
```

```python
def compute(
    obj: MyData | pathlib.Path | str,
) -> Result:
    if isinstance(obj, str):
        obj = deserialize(redis.get(obj))
    elif isinstance(obj, pathlib.Path):
        with open(obj) as f:
            obj = deserialize(f.read())

    # Computation ...
    return Result(...)
```

```python
def compute(
    obj: MyData | pathlib.Path | str,
) -> Result:
    obj = resolve(obj)

    # Computation ...
    return Result(...)

def resolve(
    obj: MyData | pathlib.Path | str,
) -> MyData:
    if isinstance(obj, str):
        obj = deserialize(redis.get(obj))
    elif isinstance(obj, pathlib.Path):
        with open(obj) as f:
            obj = deserialize(f.read())
    return obj
```

```python
def compute(obj: MyData) -> Result:
    assert isinstance(obj, MyData)
    assert isinstance(obj, Proxy)
    # Computation ...
    return Result(...)

class FileFactory:
    def __init__(self, filepath: str) -> None: ...
    def __call__(self) -> MyData: ...

class RedisFactory:
    def __init__(self, key: str, address: str) -> None: ...
    def __call__(self) -> MyData: ...

compute(Proxy(FileFactory('/path/to/data')))
```

The proxy *looks* like `MyData`…

but *only* contains the code for how to become `MyData`.

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Why ProxyStore?

`Store` Interface

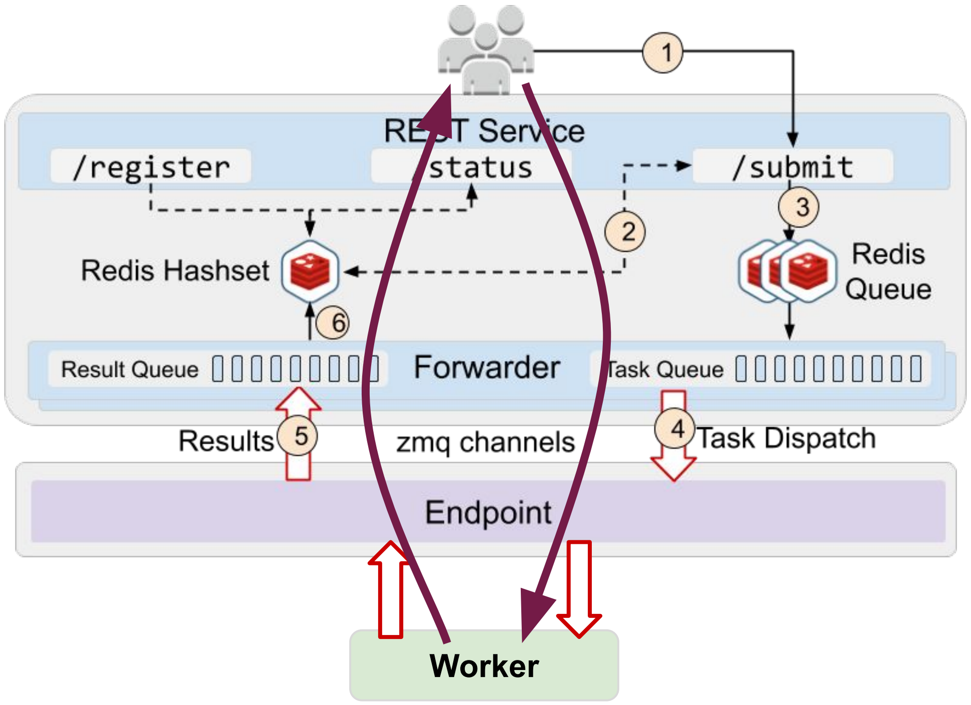
- `.proxy()` method
- Factory implementations:
    - Shared file systems
    - Redis/KeyDB
    - Globus
    - Easy to add new ones

Proxies *look* like the object…

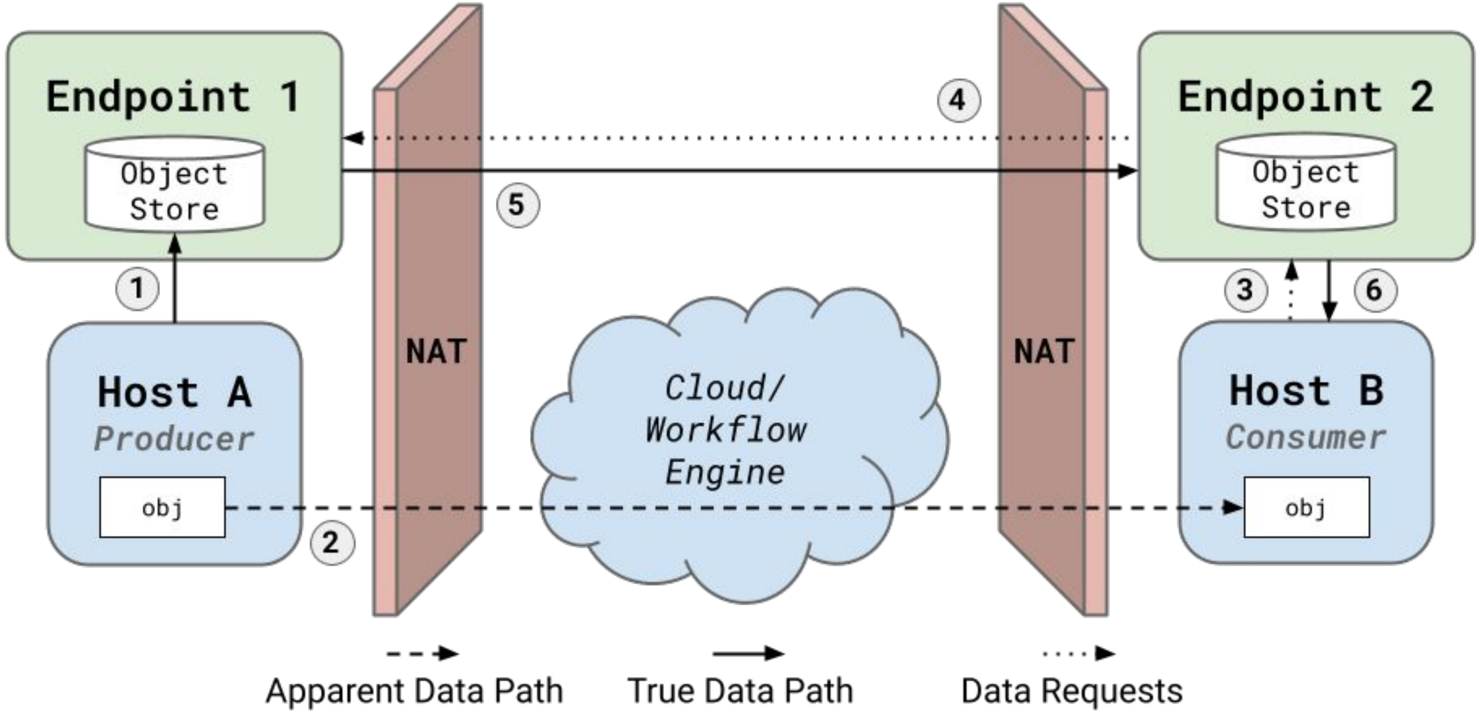
only contain how to retrieve the object from the store that created them

```python
from proxystore.store import init_store

def compute(obj: MyData) -> Result:
    # Computation ...
    return Result(...)

# Stores registered globally
store = init_store(
    'redis', name='mystore1', hostname=..., port=...
)
store = init_store(
    'file', name='mystore2', data_dir=...
)

compute(store.proxy(obj))
```

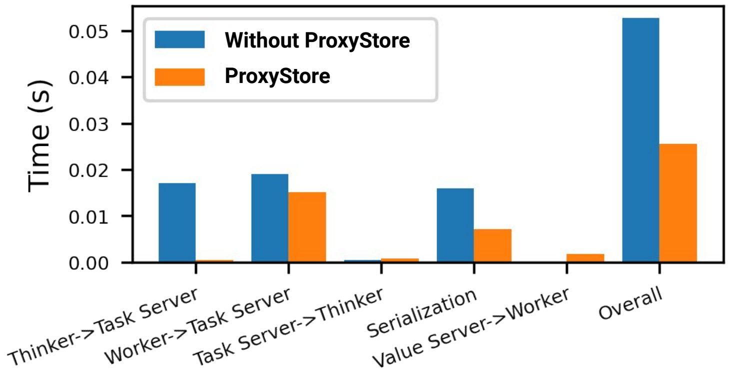
Avoid unnecessary communication

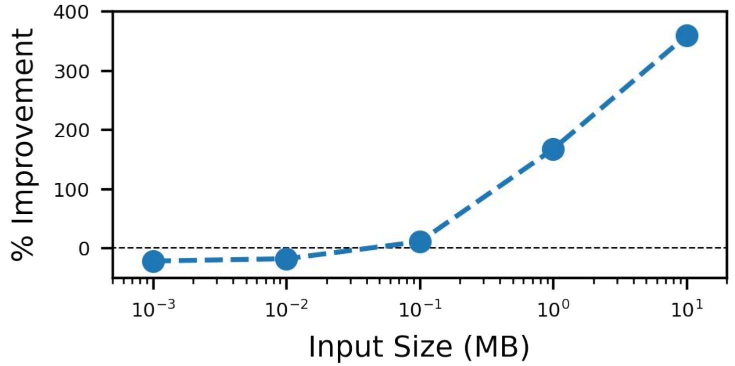


Easy RDMA + Multi-site Workflows

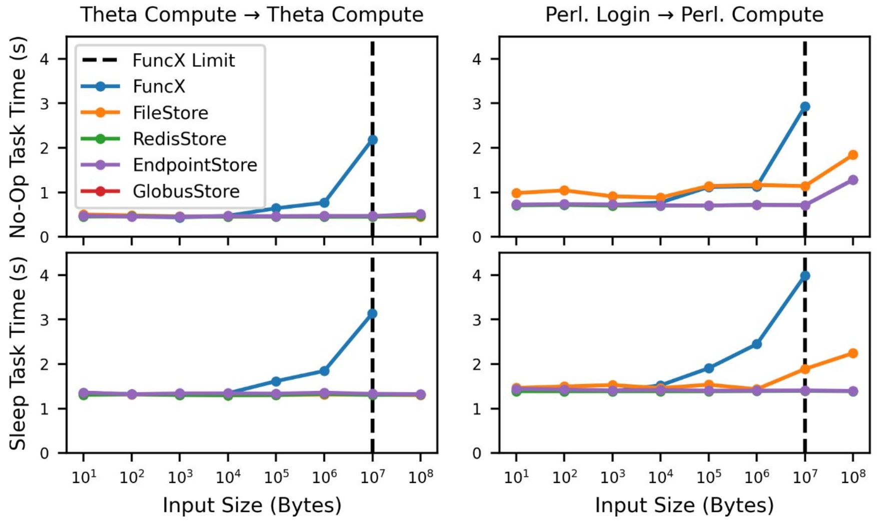


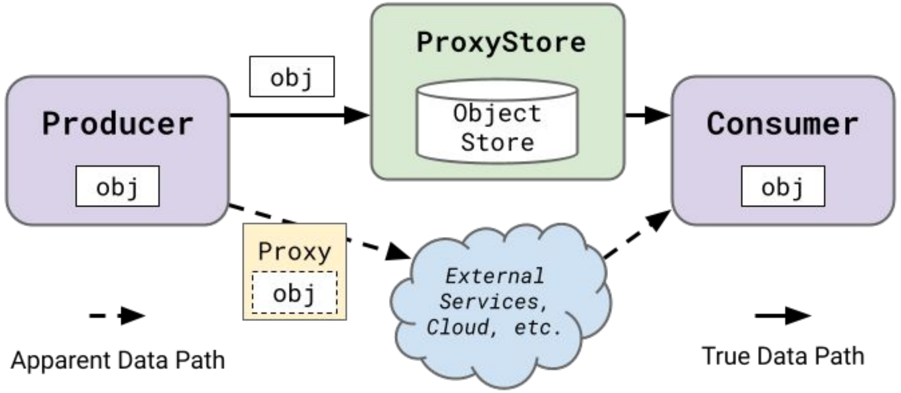
Colmena + Parsl





Vanilla FuncX





Questions?

jgpauloski@uchicago.edu

github.com/proxystore

proxystore.rtfd.io