Sharing GPUs and Programmable Switches in a Federated Testbed with SHARY

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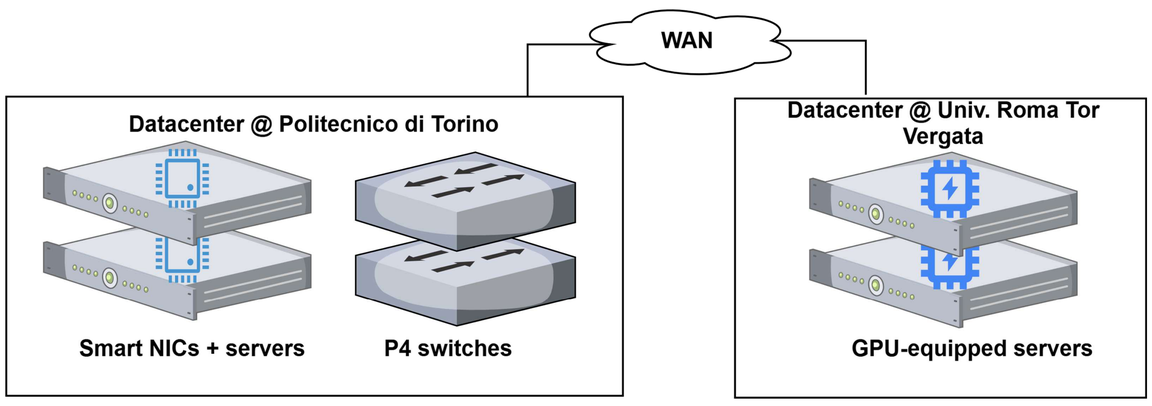
RESTART Distributed Testbed



- **Servers with GPUs**
- **Smart NICs**
- **Programmable (P4) Switches**

Sharing resources in Federated Testbed

Underutilization of Specialized Hardware:

- GPUs and other high-performance resources are often idle despite high demand.
- Fixed allocations lead to inefficiencies in federated environments.

Static Resource Allocation Limits Flexibility:

- Traditional reservation models rely on **static partitions** or **fixed time slots**.
- These approaches fail to adapt to **variable workload demands**.

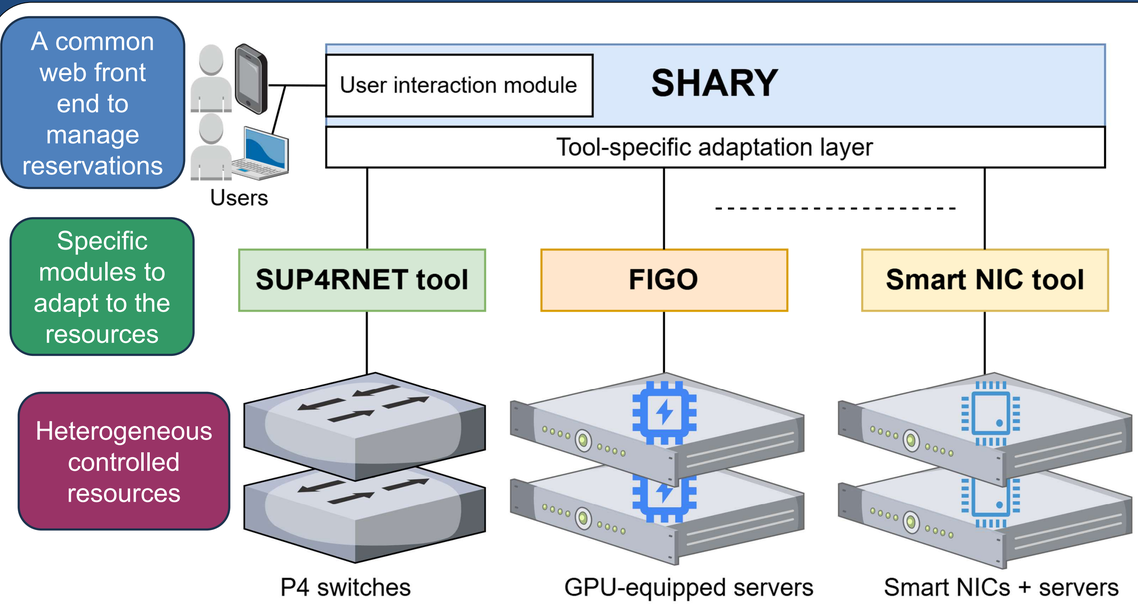
Heterogeneity of Resources and Interfaces:

- Federated testbeds integrate diverse hardware (GPUs, CPUs, SmartNICs, FPGAs…).
- Different managem. protocols and software environments complicate resource sharing.

Lack of Dynamic Coordination Mechanisms:

- Scheduling across **multiple sites** with different infrastructures is challenging.
- Researchers need **on-demand access** rather than rigid booking models.

SHARY - SHaring Any Resource made easY



Addressed Gaps

1 Rigid Reservation Systems Lead to Wasted Resources

- Traditional calendar-based systems rely on fixed time slots, leading to underutilization.
- Researchers book longer-than-needed slots to avoid interruptions.
- Need for adaptable and dynamic reservation mechanisms.

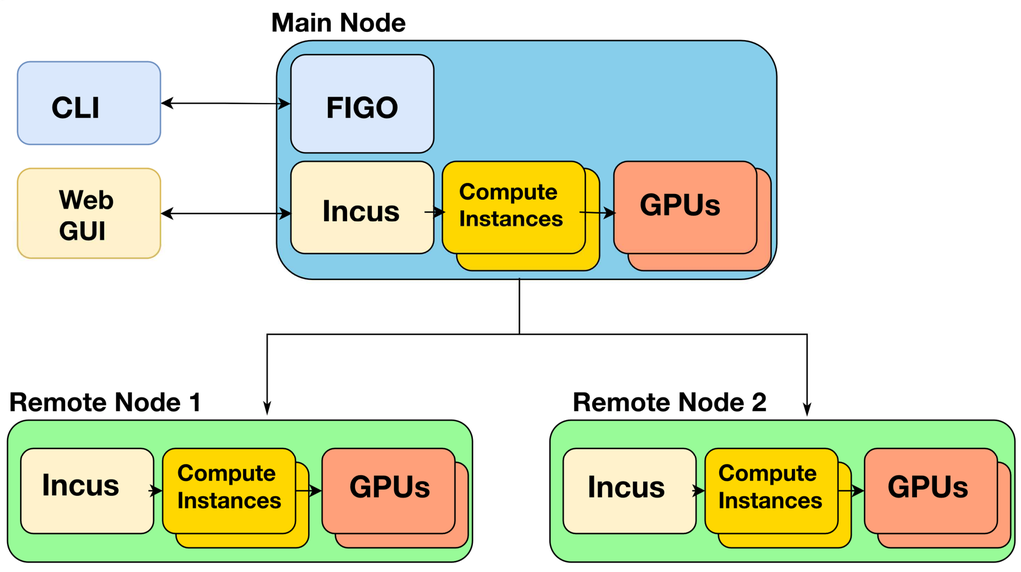
2 Inefficient GPU Sharing Mechanisms

- Static partitioning methods waste capacity when full GPU power is not required.
- Real-time reallocation is needed to maximize utilization.
- FIGO introduces on-the-fly GPU allocation based on user demand.

3 Lack of Multi-Tenant Support in Networking Hardware

- Programmable networking devices lack native multi-tenancy.
- Currently, switching between experiments requires reconfiguration → disruptive.
- Need for parallel access and isolation mechanisms to allow multiple users.

FIGO - Federated Infrastructure for GPU Orchestration

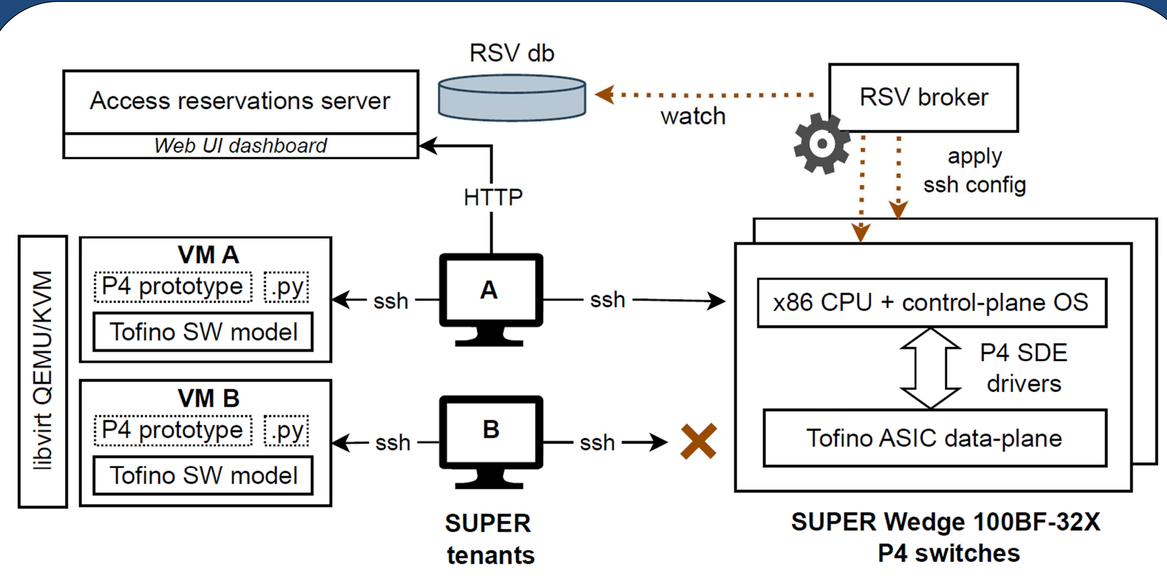


FIGO architecture: each Remote Node runs an instance of incus, coordinated by main node

Flexible GPU Orchestration Framework

- Dynamically allocates GPUs based on real-time demand, reducing idle time.
- Integrates with SHARY for flexible, automated resource booking.
- Optimizes GPU usage across federated testbeds, lowering costs and accelerating AI research.

Federating P4 Switches with SUP4RNET



Architecture of the SUP4RNET P4 cluster and enabled P4 development workflow

Multi-Tenant Support for Programmable Switches

- Enables secure, isolated sharing of P4-based switches among multiple users.
- Reduces downtime by managing dynamic access without full reconfigurations.
- Supports both parallel and sequential access, enhancing network experimentation.

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