

Novel Network Services for Supporting Big Data Science Research

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Website: <http://www.atlanticwave-sdx.net/>

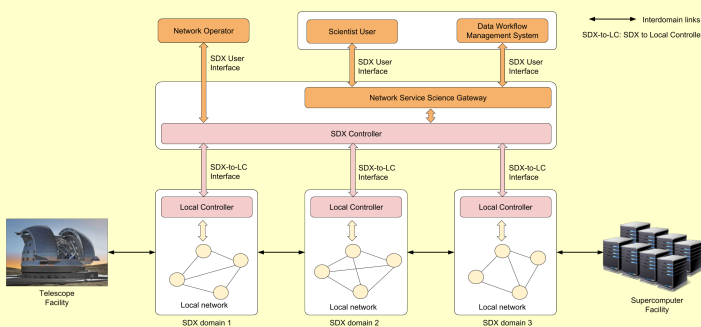
Introduction and Motivation

- Research and Education (R&E) networks allow experimenters to establish dedicated connections between research facilities for transferring large amounts of data.
- R&E networks have started using Software-Defined Networking (SDN) and Software-Defined Exchanges (SDX) for deploying dedicated network connections.
- AtlanticWave/SDX is a response to the growing demand to support end-to-end science network services spanning multiple SDN domains.

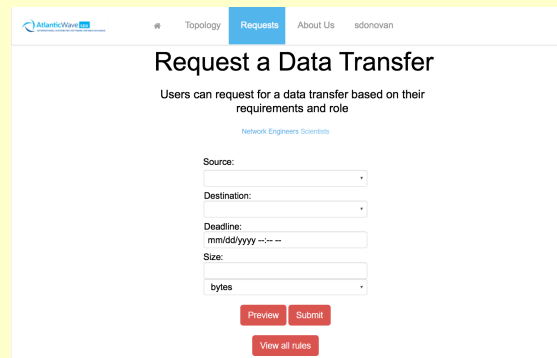
Limitation of the Current Model

- Interfaces of R&E networks have been developed by network operators for network operators, making more challenging the process of requesting science network services for domain-expert scientists that are not networking experts.
- Reservations are defined by duration and bandwidth, so the scheduling of resources is not flexible; that is, a reservation request will fail if the exact amount of bandwidth is not available within the specified time frame, which forces the scientist into a cycle of trial and error until a suitable time frame is found.

AtlanticWave/SDX Architecture



AtlanticWave/SDX User Interface



Use Cases

- **Domain-expert scientist interfaces for requesting data transfers:** an experimenter may reserve network resources through AtlanticWave/SDX, the SDX controller evaluates whether a path that meets the end-to-end requirements can be formed, and request it on behalf of the scientist.
- **Bandwidth calendaring:** experimenter selects at what hours of the day she will need a reservation, and AtlanticWave/SDX will provision resources dynamically.
- **Predictive reservation services:** use machine learning (ML) on data transfer patterns and historical reservation data to generate reservation suggestions.
- **Green path:** science network services based on proximity of dataset repositories or network congestion.

Ongoing Research

- Study the composition of end-to-end services at the SDX controller and how these services should be exposed to users and applications through the user/application interface.
- Rule translation from user-level, local controller-level, and switch-level abstractions.
- Identity and access management (IAM) systems for AtlanticWave/SDX.
- Deployment of the AtlanticWave/SDX infrastructure in the three initial locations (i.e., Atlanta, Miami, and Sao Paulo).
- Study the ways that domain-expert scientists interact with the AtlanticWave/SDX controller.

Acknowledgements

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References

- [1] J. Chung, J. Cox, J. Ibarra, J. Bezerra, H. Morgan, R. Clark, and H. Owen, "AtlanticWave-SDX: An International SDX to Support Science Data Applications," in Software Defined Networking (SDN) for Scientific Networking Workshop, SC'15, Nov. 2015, pp. 1-7
- [2] "AtlanticWave/SDX controller prototype," <https://github.com/atlanticwave-sdx/atlanticwave-proto>, accessed: 2017-08-11.