Project Summary

Overview

TN Tech has nearly doubled its amount of externally-funded research from $11 M in 2015 to $20 M in 2020, and plans to reach $40 M of externally-funded research by 2025.

Intellectual Merit

The acquisition of Warp 1 will enable research projects aligned with four of NSF's 10 Big Ideas.

Broader Impacts

TN Tech has a strong history using HPC in workforce development at all levels.

Project Description

A: Information about the Proposal

Instrument Location: Tennessee Tech University, Clement Hall Room NNN
Instrument Type: HPC cluster with high-speed networking and data storage for active jobs

B: Research Activities to be Enabled

This cluster will provide an easily-accessible computing facility that immediately benefits TN Tech's research efforts across several departments and research centers to advance both fundamental and applied research in science and engineering.

B.1: Intellectual Merit

The proposed Warp 1 cluster will enable research projects aligned with four of NSF's 10 Big Ideas.

B.2: Users and Representative Scientific Research

This section details a selection of research projects.

Next-Generation Genomics: Faculty 1, Department 1; Faculty 2, Department 2; Faculty 3, Department 3 (Other University) (5 faculty, 1 postdoc, 7 graduate students, 2 undergraduate students) Funded projects in our labs use HPC resources to (1) generate genome-wide DNA data to inform on the management of endangered species [1], (2) survey community composition based on DNA extracted from environmental sources [2], and (3) investigate evolutionary processes in model organisms [3].

Broader Impacts

Here we have a statement of broader impacts, which is often required as its own heading.

B.3: Results from Prior NSF Support

Award N ($123,456, 2/2019–1/2022) "REU: Title" (Lastname, Senior Personnel)

Intellectual Merit Dr. Lastname is part of an expert group of faculty members who mentor REU participants in certain topics, by helping students to (1) conceive, design, implement, and assess research projects in this area; and (2) learn diverse different toolsets in domains such as example 1, example 2, and example 3.

Broader Impacts Dr. Lastname's portion of the REU provided a research experience to 5 undergraduate students, including 2 female students.

Publications To date, this effort has resulted in 4 published papers [4–7], with undergraduate and graduate students as first two authors.

Table 1: Selection of externally-supported users impacted by the proposed equipment

Field	User	Applications	Support
Department 1	Faculty 1	Materials science	NSF
	Faculty 2	Molecular dynamics	CWRU, DOD
Department 2	Faculty 3	Fundamental science	NSF

Table 2: Summary of science drivers' communities, attributes, solutions from proposed upgrades

	Needs				People[1]	
Field of Study: Driver	CPUs	GPUs	Infiniband	Representative software used	Faculty	Students
Field 1:						
Project 1	✔	✔	✔	Item 1, Item 2, Item 3	2	**3**
Project 2	✔	✔	✔	Item 4, Item 5, Item 6	**6**	**3**
Project 3	✔	✔	✔	Item 7, Item 8, Item 9	2	**10**
Field 2:						
Project 4		✔		Item 4, Item 10, Item 11	1	1
Project 5	✔	✔	✔	Item 12, Item 13, Item 4	**3**	6

[1] **Bold blue** faculty count indicates multi-institutional project, **bold red** student count indicates inclusion of under-represented groups.

References Cited

[1] Davoud Torkamaneh, Jérôme Laroche, and François Belzile. "Genome-Wide SNP Calling from Genotyping by Sequencing (GBS) Data: A Comparison of Seven Pipelines and Two Sequencing Technologies". In: *PLOS ONE* 11.8 (Aug. 2016), pp. 1–14. DOI: 10.1371/journal.pone.0161333.

[2] Corinne Watts et al. "DNA metabarcoding as a tool for invertebrate community monitoring: a case study comparison with conventional techniques". In: *Austral Entomology* 58.3 (2019), pp. 675–686. DOI: 10.1111/aen.12384.

[3] Carla Hurt et al. "First Worldwide Molecular Phylogeny of the Morphologically and Ecologically Hyperdiversified Snapping Shrimp Genus *Alpheus* (Malacostraca: Decapoda)". In: *Molecular Phylogenetics and Evolution* (in press).

[4] Ramesh Paudel, Timothy Muncy, and William Eberle. "Detecting DoS Attack in Smart Home IoT Devices Using a Graph-Based Approach". In: *2019 IEEE International Conference on Big Data (Big Data)*. 2019, pp. 5249–5258. DOI: 10.1109/BigData47090.2019.9006156.

[5] Ramesh Paudel, Peter Harlan, and William Eberle. "Detecting the Onset of a Network Layer DoS Attack with a Graph-Based Approach". In: *International Conference of the Florida AI Research Society (FLAIRS)*. May 2019, pp. 38–43.

[6] Ramesh Paudel et al. "Cognitive Health Prediction on the Elderly Using Sensor Data in Smart Homes". In: *International Conference of the Florida AI Research Society (FLAIRS)*. May 2018, pp. 317–322.

[7] Lenin Mookiah, Chris Dean, and William Eberle. "Graph-Based Anomaly Detection on Smart Grid Data". In: *International Conference of the Florida AI Research Society (FLAIRS)*. May 2017, pp. 306–311.