



# Storage: Yesterday, Today and Beyond

## Storage and Backup Team

IST



### In the beginning

The CCS storage team formed in 2005 to provide centralized, highly available enterprise storage services to campus.

The group administered three fixed-frame arrays on the Storage Area Network (SAN) in the Data Center, with a total of 100 TB raw capacity. All storage consisted of spinning disk drives in a mix of sizes and performance characteristics, offered in multiple tiers ranging in price from \$4 to \$2 per gigabyte.

Network Attached Storage (NAS) services at that time provided support for many central campus applications continuing in use today, including the original implementation of CalMail.

In the intervening years, growing demand for storage allowed the introduction of newer, more cost-effective storage technology, such as modular arrays.

Continually increasing allocated capacity on customers' systems eventually overwhelmed the backup system and its tape library. All backup data was moved to disk storage, managed by Virtual Tape Library (VTL) servers.

An added benefit of the transition in backup infrastructure has been the improvement in Business Continuance capabilities at our San Diego Supercomputing Center (SDSC) facility.

### Toward the Present

The storage team's primary objective has always been to reduce the cost of high availability storage to campus customers. Over the years, evolving technology enabled tremendous growth in capacity and performance, while greatly reducing customers' rates.

Today, between the Warren Hall Data Center and the SDSC Disaster Recovery facility, the Storage and Backup Group maintains 4 PB raw capacity, with nearly 70% allocated. Through the IS System Team's Virtual Private Servers, as well as Campus Shared Services IT NAS offerings, SBG serves thousands of campus users.



### Currently

Customers are requiring more and more storage to satisfy the increasing demands of applications and regulatory requirements. They also need that storage to be faster and less expensive while maintaining high availability and redundancy.

The storage team is meeting those requirements.

We have incorporated flash arrays into our SAN environment with 1 Petabyte of storage, initially to provide high speed, low latency storage for virtual applications and desktops. Then we included databases and other latency sensitive applications. Now we are in the process of moving most all Performance Tier customers to flash storage. Customers are seeing dramatic performance increases.

By offering newer faster technology, we have been able to reduce Performance Tier rates by 95% over the last eight years, to stay competitive with off campus providers.

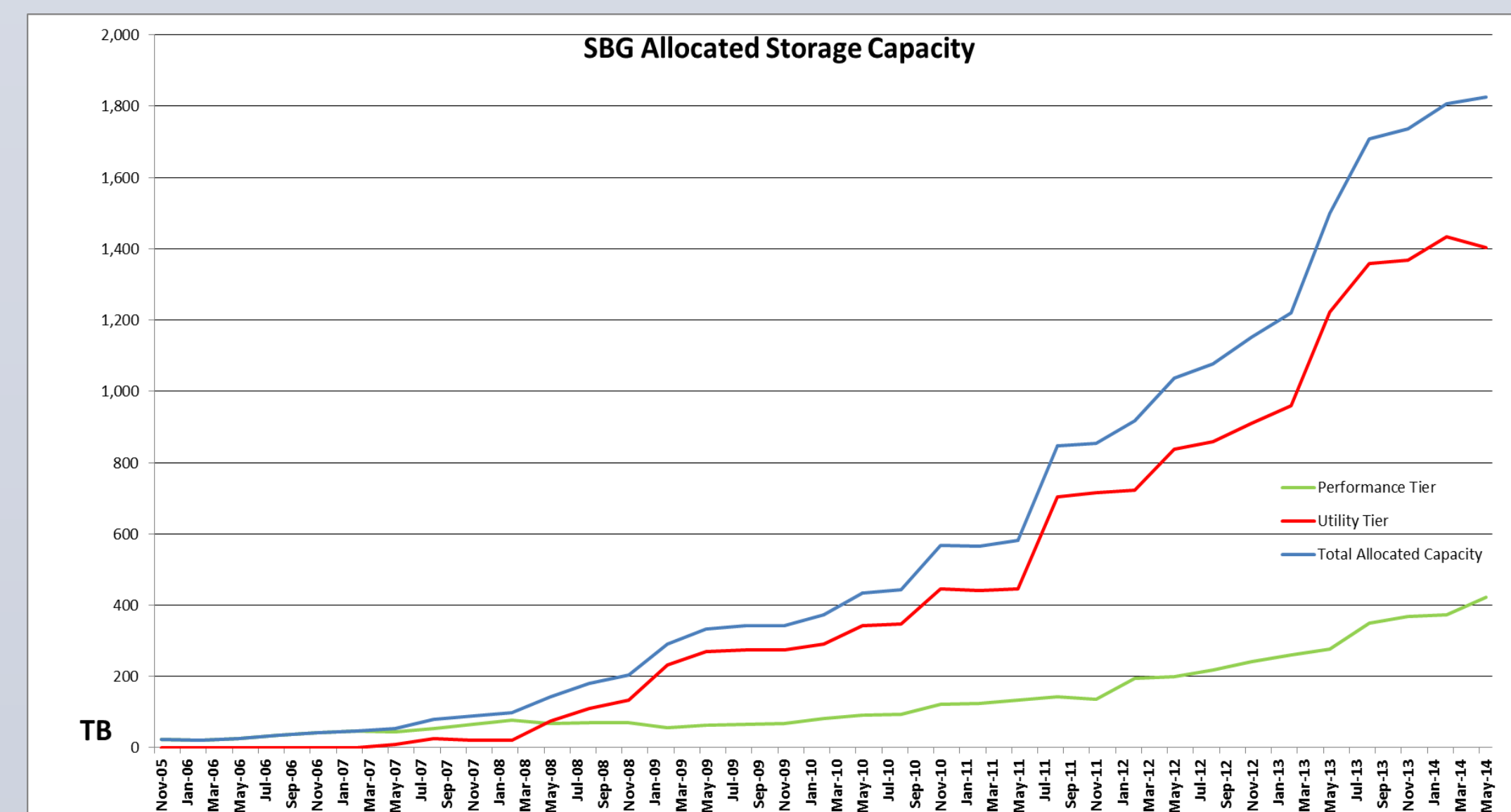
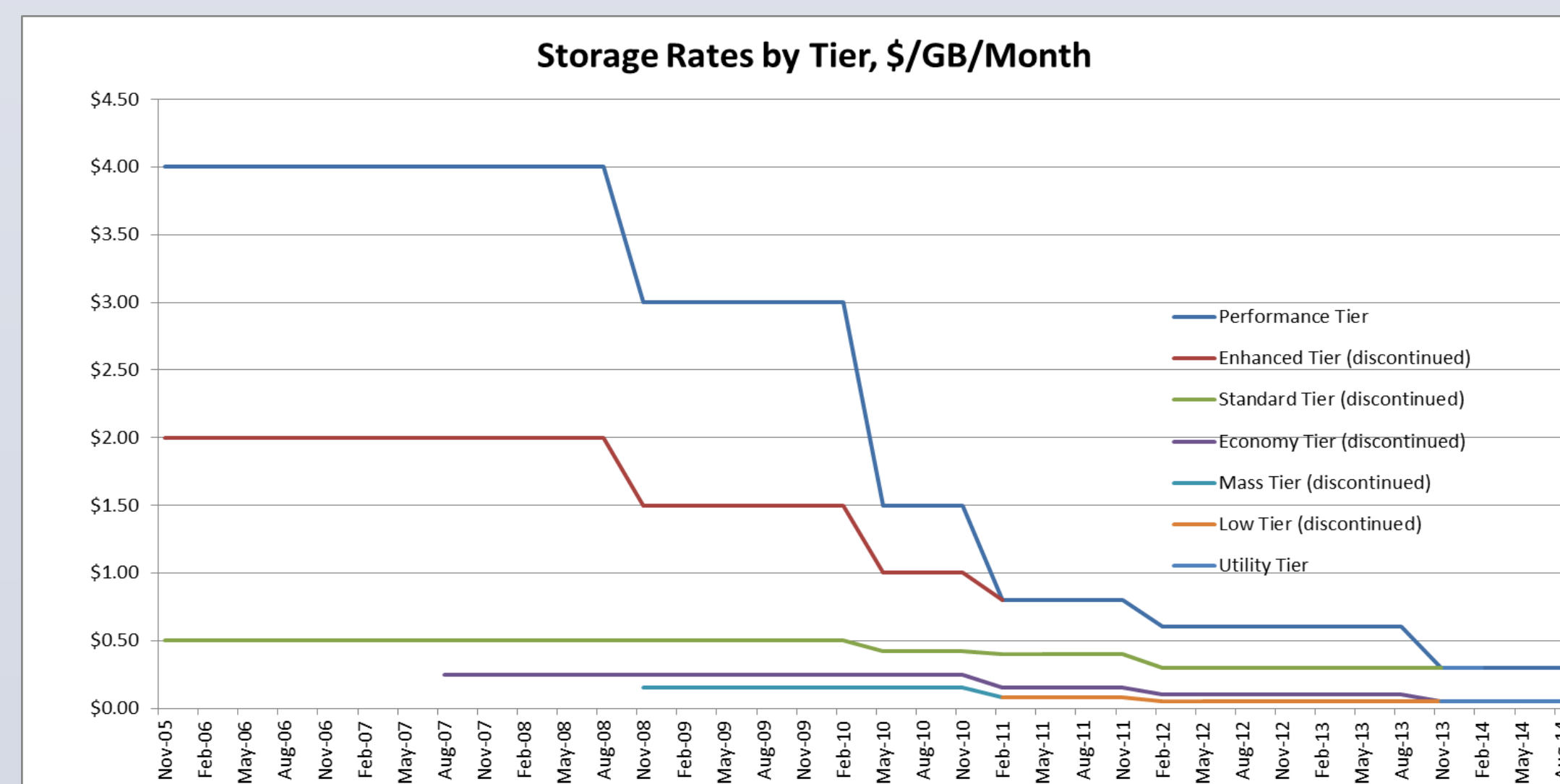
The Utility Tier storage continues to offer affordable dense storage suitable for large data sets and applications that are not latency sensitive.

We have been able to reduce Utility Tier rates by 97% to stay competitive with off campus providers.

Our NAS environment offers NFS, CIFS and iSCSI protocols with full AD integration. We offer Multiple 10 Gbps Ethernet interfaces and "FlashCache" SSD read cache in each controller. SnapVault repositories will provide business continuity backups for UC campuses and units using NetApp filers in their IT operations.



Storage Rates by Tier, \$/GB/Month



### In the future

The storage team will continue to expand on its flash disk offerings and continue to look for new and innovative ways to stay current with demanding applications and new storage trends.

In the very near future all our Performance Tier storage will operate exclusively on flash storage. We will offer flash storage at our disaster recovery site with the ability to snapshot your data. This will provide identical performance and near instant recovery points should you need to recover your data.

The utility tier storage will move away from spinning SATA drives and begin to offer performance that was once considered cutting edge just a few years ago.

Our NAS, Networked Attached Storage, will become more robust and available to a wider range of applications because of the faster network, flash implementation and secure data transmission.



### Contact the Storage Team

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