

TECH NOTE

Nutanix Database Service Time Machine



Copyright

Copyright 2022 Nutanix, Inc.

Nutanix, Inc.
1740 Technology Drive, Suite 150
San Jose, CA 95110

All rights reserved. This product is protected by U.S. and international copyright and intellectual property laws. Nutanix and the Nutanix logo are registered trademarks of Nutanix, Inc. in the United States and/or other jurisdictions. All other brand and product names mentioned herein are for identification purposes only and may be trademarks of their respective holders.

Contents

1. Introduction.....	4
Document Version History.....	4
Nutanix Database Service.....	4
2. Nutanix Database Service Time Machine.....	5
SLA and Schedule.....	5
Registration.....	5
Time Machine's First Snapshot.....	6
How Time Machine Collects Logs.....	7
Time Machine with First Set of Logs.....	7
Second-Day Operations.....	8
Ongoing Operations.....	9
The First Log Purge.....	10
Time Machine After Two Weeks.....	12
3. Conclusion.....	14
About Nutanix.....	15
List of Figures.....	16

1. Introduction

In this document, we approach the core construct of the copy data management service in Nutanix Database Service (NDB) (formerly Nutanix Era): the time machine. We look at how a time machine manages or captures its data to deliver the recovery point objective (RPO) service-level agreement (SLA) imposed on it.

Document Version History

Version Number	Published	Notes
1.0	January 2019	Original publication.
1.1	January 2020	Annual update.
1.2	February 2021	Annual update.
1.3	July 2022	Updated product naming from Nutanix Era to Nutanix Database Service.

Nutanix Database Service

NDB (formerly Nutanix Era) automates and simplifies database administration, bringing one-click simplicity and invisible operations to database provisioning and life-cycle management.

NDB enables database administrators to perform operations such as database registration, provisioning, cloning, patching, and restore. It allows administrators to define provisioning standards with end-state driven functionality that includes network segmentation, high availability database deployments, and much more.

With the NDB multicluster capability, you can easily manage databases across multiple locations, both on-premises and in the cloud, with Nutanix clusters.

For more information, read the [NDB solution brief](#).

2. Nutanix Database Service Time Machine

SLA and Schedule

Consider a simple SLA: you want the most recent week's worth of continuous RPO, tapered off with daily backups for an additional week.

Table: Sample Simple RPO SLA

Type	Time
Continuous	7 days
Daily backups	7 days

With NDB, you can specify the SLA during database registration and onboarding. While setting the outline for the SLA, you can also customize how the system achieves it. NDB allows you to specify the number of backups or snapshots the time machine should take, the time of day it takes those snapshots, and the day of the week it takes weekly or monthly backups. These options help you build a complete schedule of time machine capture operations. The time machine comes with a preconfigured default schedule to get you up and running quickly, so you don't have to customize scheduling unless your specific business needs require something different.

Registration

NDB completes the following tasks as part of the onboarding process:

- Discovers the logical layout of the database.
- Maps the physical disk resources underlying the database.
- Creates the protection domain entity (if it does not already exist).
- Creates a time machine entity tasked with maintaining the SLA.

- Deploys an NDB agent or collector on the database host.
- Performs a few additional smaller actions to prepare the database entity for NDB management.

As NDB activates the time machine construct, it takes the first snapshot of the database (and OS).

Time Machine's First Snapshot

The following diagram depicts a time machine's content on the first day, when it takes its first snapshot. Note that this is an application-consistent snapshot or, in other words, a functional synthetic full backup.

In Oracle, for example, this snapshot is equivalent to an RMAN-created backup for your restore needs. We use product-specific APIs (`begin backup` and `end backup`) to quiesce the database and perform the backup operation using Nutanix snapshots.

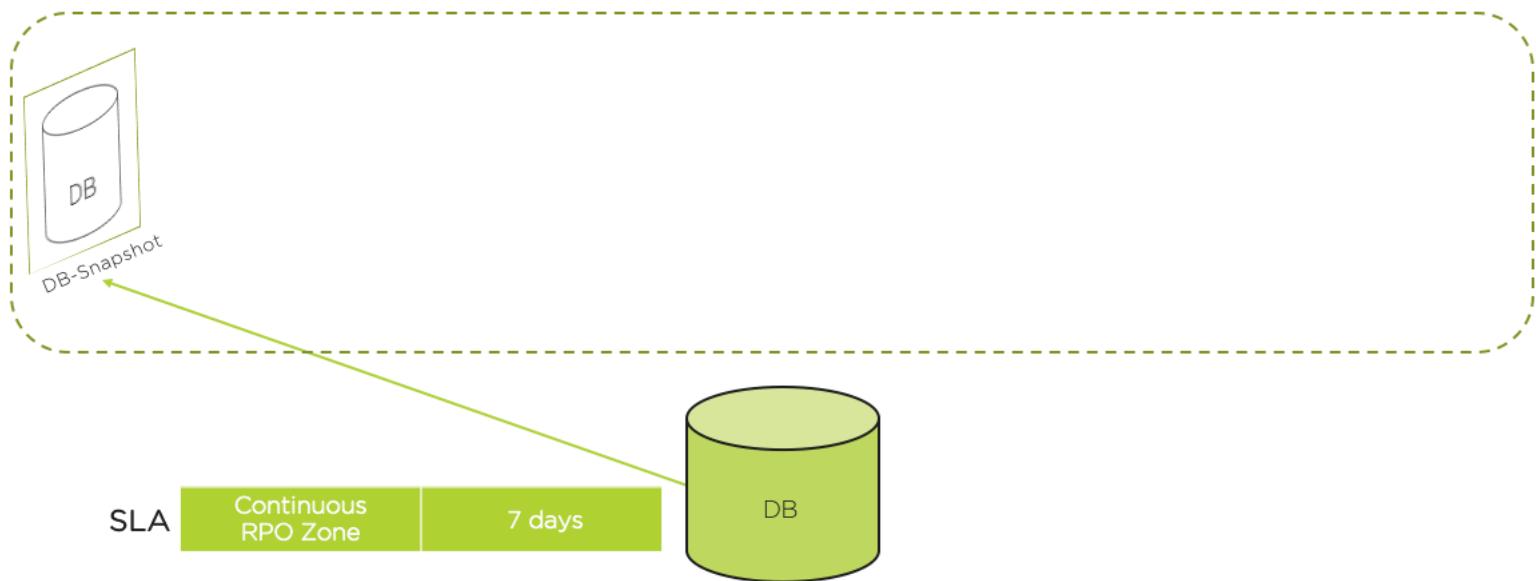


Figure 1: Time Machine: First Snapshot

Now the stage is set for the time machine's second act: log collection. When it comes to database protection and clone management, customers generally follow rigid, well-established practices approved by database vendors. Typical database protection involves combining either full or incremental backups with transaction logs to achieve point-in-time recovery.

NDB keeps these approved processes intact while making them more efficient and elegant. To reduce friction for DBAs, we have replaced traditional backups with synthetic full backups or snapshots, with the rest of the process remaining the same. NDB collects transaction logs periodically (for example, at 15-minute, 30-minute, or 60-minute intervals) as directed by the customizable time machine schedule. We call this process the time machine's log catch-up function.

How Time Machine Collects Logs

To achieve efficient log collection, the NDB agent on the database host maintains a small staging disk (either dedicated or shared, using existing disks). The agent periodically sweeps the logs from the database to this staging location. From the staging disk, NDB initiates the log-sync process, which moves staging disk content to the time machine's permanent (durable) disk.

Time Machine with First Set of Logs

The following figure shows the time machine state after a couple of log catch-up operations.

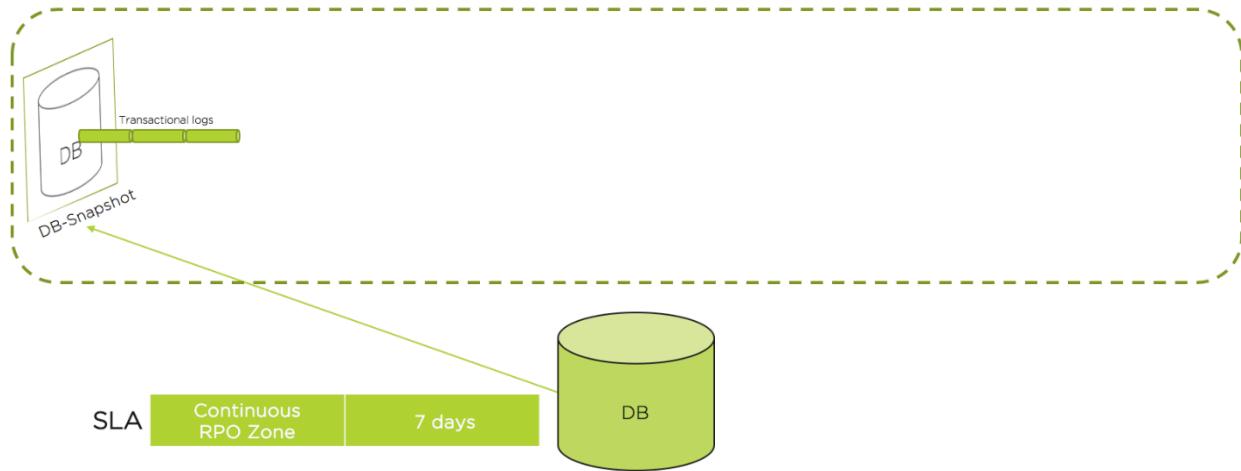


Figure 2: Time Machine After Log Catch-Up Operations

Second-Day Operations

When the second day arrives, admins usually perform a backup of their database. Typically, this second-day backup is incremental, but it can occasionally be a full backup. The time machine exactly follows this standard, performing a backup or snapshot operation on the schedule's second day.

Note: You can back up the database more than once a day. However, for simplicity, we call it "second-day backup" here.

Nutanix backups and snapshots are all always incremental; however, NDB can use them as full or synthetic backups to meet your restore needs.

The following figure shows the time machine's content on the second day, shortly after backup.

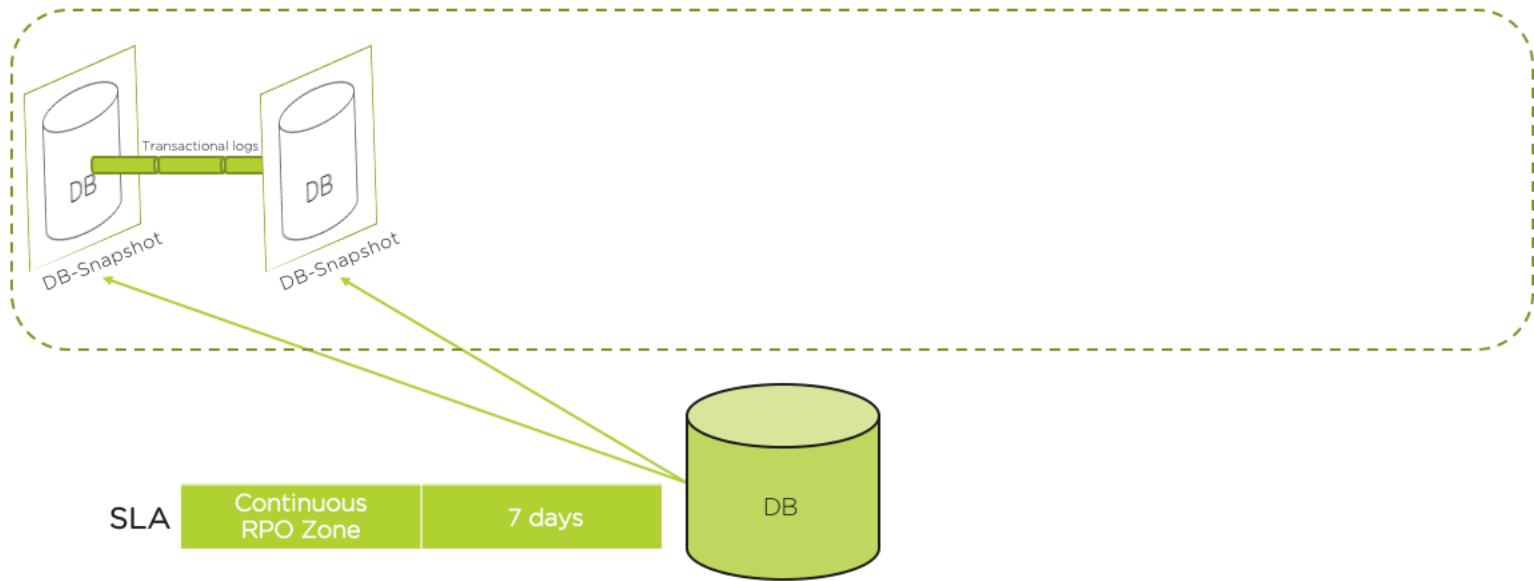


Figure 3: Second-Day Time Machine Content

Ongoing Operations

Following the sample RPO SLA we defined earlier, the process described previously continues for the first seven days. The following figure represents the time machine at the start of eighth day.

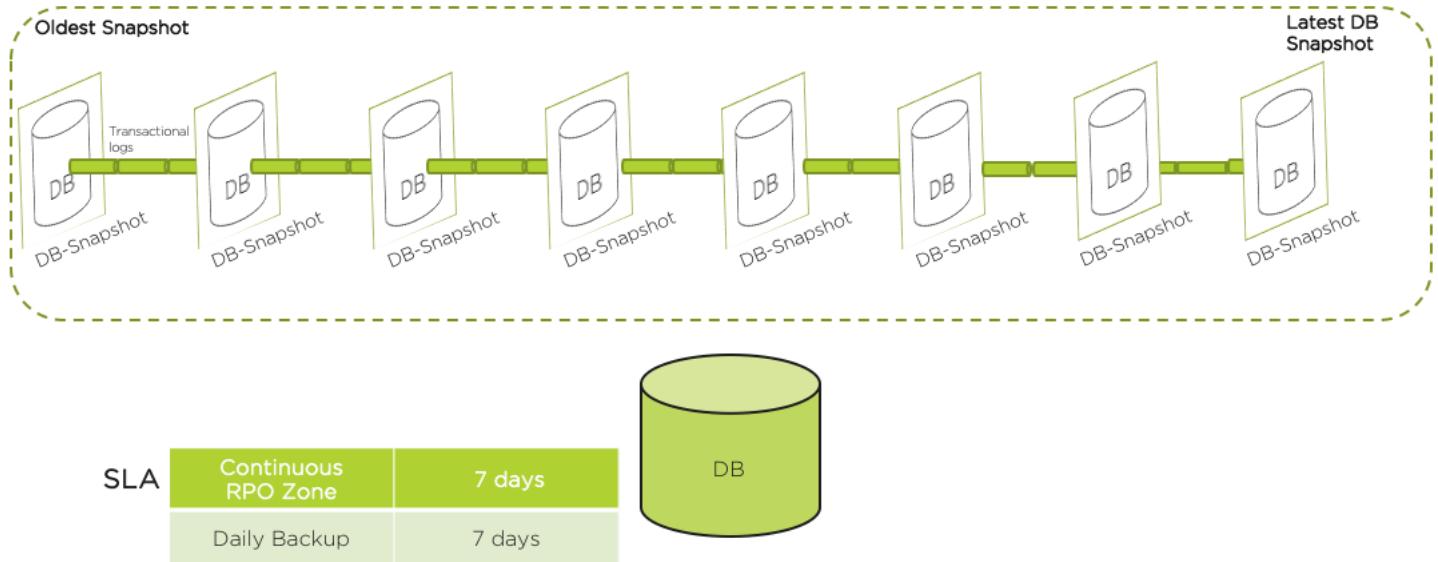


Figure 4: Time Machine on Day Eight

The First Log Purge

According to our sample RPO SLA, NDB must maintain seven days of time-travel capability to any second, plus an additional seven days of discrete recovery at a daily interval. Therefore, at day eight, the time machine can start to prune the logs it manages. The time machine examines its log disk for content beyond what the RPO requires and purges that content. The following figure depicts the time machine at this examination stage.

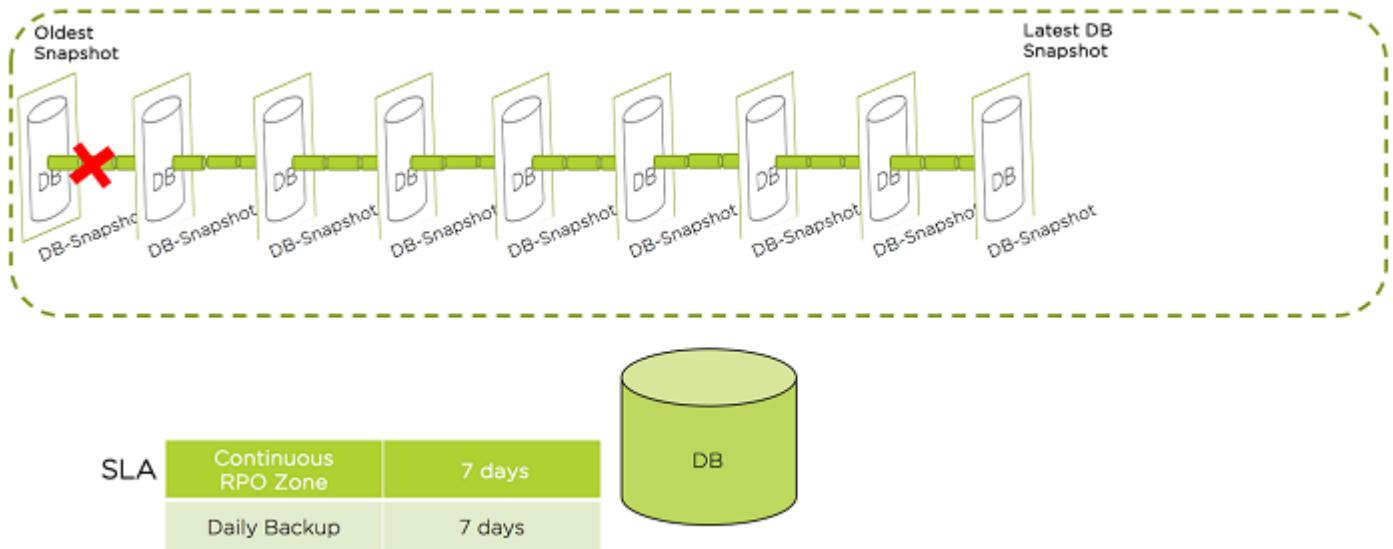


Figure 5: Time Machine Log Examination

The following figure represents the time machine after it has purged the logs of continuous content older than seven days.

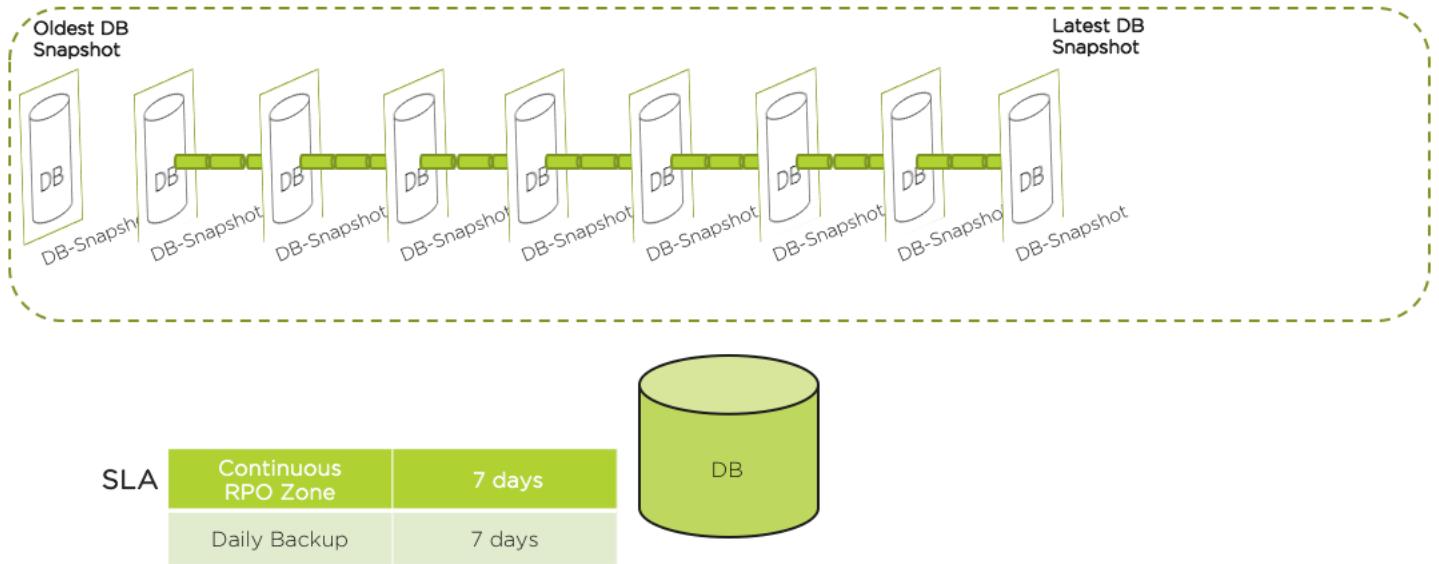


Figure 6: Time Machine After First Log Purge

Time Machine After Two Weeks

The following figure shows the time machine at the end of the second week.

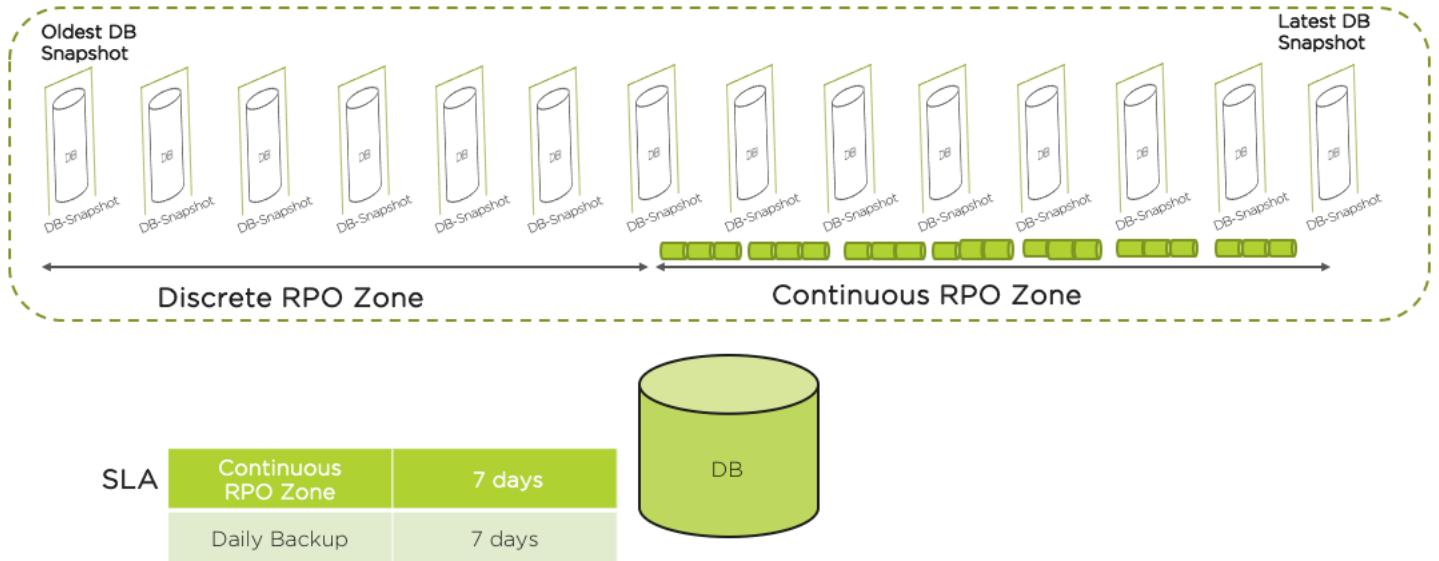


Figure 7: Time Machine Logs at Two Weeks

3. Conclusion

We hope you now have a better understanding of what happens when you register your database with NDB. The time machine entity captures essential data in the form of snapshots (synthetic full backups) and transaction logs, preserving well-established database data protection practices while making them more elegant and efficient.

About Nutanix

Nutanix is a global leader in cloud software and a pioneer in hyperconverged infrastructure solutions, making clouds invisible and freeing customers to focus on their business outcomes. Organizations around the world use Nutanix software to leverage a single platform to manage any app at any location for their hybrid multicloud environments. Learn more at www.nutanix.com or follow us on Twitter [@nutanix](https://twitter.com/nutanix).

List of Figures

Figure 1: Time Machine: First Snapshot.....	6
Figure 2: Time Machine After Log Catch-Up Operations.....	8
Figure 3: Second-Day Time Machine Content.....	9
Figure 4: Time Machine on Day Eight.....	10
Figure 5: Time Machine Log Examination.....	11
Figure 6: Time Machine After First Log Purge.....	12
Figure 7: Time Machine Logs at Two Weeks.....	13