Minimizing Customer Interruptions Due to SSD Failures

Brennan Watt
Exciting Things are Happening…

Data Segregation
- Stream A
- Stream B
- Stream C

Performance Isolation
- Set A
- Set B
- Set C

Smart SSDs

Failure Handling
Importance of Availability

<table>
<thead>
<tr>
<th>MONTHLY UPTIME PERCENTAGE</th>
<th>SERVICE CREDIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 99.9%</td>
<td>10%</td>
</tr>
<tr>
<td>&lt; 99%</td>
<td>25%</td>
</tr>
<tr>
<td>&lt; 95%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Microsoft will pay customers back when SLA is not met.
Failure Definition

For IaaS, any time we cannot get the data in a reasonable amount of time

Disk failures are more than just asserts. Think like a VM
Solutions

Data Replication

Data Protection

$
Failure Prediction

Surprise Disk failures are extremely painful
SSD Failures

1. Host View

2. Internal View

3. Indicators
Why SSDs Fail: Host View

1. SSD returned uncorrectable status
2. SSD in FW protected mode
3. SSD not responding to IO
Why SSDs Fail: Internal View

- Media Wear out
- DRAM Uncorrectables
- Capacitor Failures
- Firmware Logic Bugs
Failure Indicators

- **Symptoms:**
  - Data errors (uncorr and CRC)
  - Sector reallocations
  - Program/Erase failures
  - SATA Downshift

- **DC Decisions**
  - High write volume
  - High write amplification

Able to identify 71% of failures using these indicators w/ 13% false positive
Emerging Failure Indicators

- DRAM single bit flips
- Capacitor degradation

Expanding Telemetry Data to Cover All Dominant Failure Signatures
Call to Action

SMART data is only scratching the surface of useful information

Collections view enables superior insight into failure trends

Microsoft is collaborating with vendors to provide more telemetry data to enable more accurate failure predictions