The Pandemic and The Classroom

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Group Engineering Manager
Microsoft Teams for Education
Agenda

- Microsoft Teams Architecture
- “Education” → “Remote Education”
- Strategies for scale and resilience,
- Techniques for incident management and product support
- Key Takeaways
Teams Architecture

Microsoft Education Apps (Assignments, ClassNotebook, Grades)

Teams Clients

Intelligent Communications
Cloud Services

Teams Services
(Teams specific aggregation and abstraction)

Microsoft 365 Core Services
(Azure Active Directory, Office365, Exchange, Sharepoint, OneDrive, Graph)

Azure

Education Services

Microsoft Education Apps (Assignments, ClassNotebook, Grades)
Solid Foundation

- CI/CD pipeline
- Gated ring-based deployment
- Alerting based on client and service defined metrics
- Analytics
- Experimentation pipeline
- Client Updates across all platforms
- Centralized Configuration Management Service
Education Audience

K-12

Educators

Students

Parents

IT Admins

Higher Education (HED)
Education Seasons

Mrs. Ross’ Schedule 2014-15

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>7:45-8:00</td>
<td>Doors open, morning routines</td>
</tr>
<tr>
<td>8:00-8:45</td>
<td>Calendar</td>
</tr>
<tr>
<td>8:45-9:05</td>
<td>SMART Time</td>
</tr>
<tr>
<td>9:05-10:25</td>
<td>Reading Block</td>
</tr>
<tr>
<td>10:30-10:52</td>
<td>Lunch</td>
</tr>
<tr>
<td>10:55-11:55</td>
<td>Math</td>
</tr>
<tr>
<td>11:55-12:28</td>
<td>Activity</td>
</tr>
<tr>
<td>12:30-1:15</td>
<td>Snack/Read Aloud</td>
</tr>
<tr>
<td>1:15-2:20</td>
<td>Writing</td>
</tr>
<tr>
<td>2:20-2:45</td>
<td>Release</td>
</tr>
<tr>
<td>2:45-3:20</td>
<td>Silent Reading</td>
</tr>
<tr>
<td>3:20-3:30</td>
<td>Short/Dismissal</td>
</tr>
</tbody>
</table>

Science and Social Studies are integrated into the reading block.

<table>
<thead>
<tr>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
</tr>
</thead>
<tbody>
<tr>
<td>PE 2</td>
<td>Music</td>
<td>Comp/Arts</td>
<td>PE 2</td>
<td>Art</td>
</tr>
</tbody>
</table>

Ideal Feature Release Timeline

- Feature Rollout
- Available
- Feature Rollout
- Available
Very quickly we had to shift the entire way we teach. Basically overnight we were told we had to shift classrooms from face to face to virtual format. We are building the plane as we fly it, it was so last minute. We are now in the resource dumping mode, constantly dumping resources at each other, ‘oh we found this, this looks good—

Assistant Principal

My biggest concern is that students are not focused, and parent will not sit with them to learn how to motivate themselves with a computer and a teacher online. In class they are directed by me and I am constantly re-directing them. At home with siblings or no parent involvement I imagine this will be horrible for class room management -

Educator
School Setup

Student Information System
- Students
- Teachers
- Classes
- Class Rosters
- Schools
- School Rosters

SIS Data

Automatic class creation and management

Azure Active Directory & Office 365

Sync data for School IT Administration

Users
- Classes
- Schools

Powering an Education Aware Platform

Microsoft Teams
-OneNote
-Office 365 Groups
-Microsoft Intune

3P Apps using Graph
School Data Sync Challenges

• Entire countries/states/districts came onboard
• All setup operations became urgent at once
• First time tenants with limited knowledge
• Challenges
  • Admin education support with Teams support group [Process]
  • Centralize incoming requests for capacity planning [Process]
  • Improve reporting to avoid unnecessary back and forth [Process]
  • Educate tenants to use multiple parallel sync profiles (3x) [Process]
  • Increase throughput per tenant by parallelizing calls (3x) [Service]
**Feature Brownouts**

- Temporary reduction in feature set to buy time in a specific region during peak load.

**Best Practices:**

- Prioritized list of brownout items with user impact along with load reduction estimate.
- Ability to uniformly apply in the same treatment to tenant/region.
- Have a plan to go back to normal operation.

<table>
<thead>
<tr>
<th>Description</th>
<th>User Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Load files as read-only to reduce load on SharePoint</td>
<td>Documents will now open in Read Only first.</td>
</tr>
<tr>
<td>Lower bit rate in free SKU’s</td>
<td>Lower video fidelity to 720p</td>
</tr>
<tr>
<td>Reduce people profile refresh frequency</td>
<td>User might see stale profile information</td>
</tr>
<tr>
<td>Disable typing indicator</td>
<td>User might not be able to see typing indicators</td>
</tr>
<tr>
<td>Disable read receipts</td>
<td>User cannot see read receipts.</td>
</tr>
<tr>
<td>Calendar pre-fetch this week only</td>
<td>Next week’s events will load only when needed</td>
</tr>
</tbody>
</table>
Optimizations

- Client/service code changes aiming to give back cores permanently.
- Best Practices:
  - Comb the backlog for known optimizations
  - Prioritize based on effort vs projected gain
  - Continuously monitor/report outcomes
  - Permanently in production with better resiliency and COGS.

<table>
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<tr>
<td>Smart session management for long lived tokens</td>
<td>network, compute</td>
</tr>
<tr>
<td>Poll-to-push whenever possible</td>
<td>network</td>
</tr>
<tr>
<td>Reduce telemetry/logging</td>
<td>network, compute, livesite investigations</td>
</tr>
<tr>
<td>Optimize initial avatar generation</td>
<td>network, compute</td>
</tr>
<tr>
<td>Stop fetching information for stale teams</td>
<td>network, compute</td>
</tr>
<tr>
<td>Better utilization of client caches</td>
<td>network, compute</td>
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Better utilization of compute resources

- Deploy microservices to more regions in a geography to reduce overall disaster recovery buffer.
- Flexibility in terms of VM type/CPU/memory
  - Operational readiness to run on different SKU’s,
  - Automation for deployment scripts, Load/performance tests
  - DV2 hardware to flex SKU’s allowing usage of Intel and AMI cores.
- Auto-scale based on recurring daily usage patterns
- Daily capacity review meetings along with forecast tracking
Networking and Routing Optimizations

- Routing Strategies to leverage idle capacity during off hours for Azure Geography
  - Non-interactive background work is dynamically migrated to idle capacity
  - Calling and meeting traffic was routed across multiple regions to handle the surge.
- New clusters not getting enough traffic in a region
  - Location of users and Azure Front Door nodes
  - Redistribute traffic at county level.
Cache and Storage Improvements

Caches would not scale with the increased load.
- Store cache state in binary format instead of JSON
- Compress data before sending it to the cache

Cache optimizations
- Overly aggressive TTL settings
- Decreased dependency on REDIS
Assignments App

- Defer provisioning of resources to actual use
- Redis Optimizations
- Retry patterns
- Auto-scale to match the “Education Day”
Resiliency Strategies

- Active-Active Fault Tolerant Systems
  - Static CDN-data hosted both on Azure Front Door and Akamai

- Circuit Breaker
  - Prevent cascading failures due to downstream service outages

- Bulkhead Isolation
  - Partition critical services to completely isolated deployments
  - Limit the impact to particular set of API’s
Resiliency Strategies

- API level rate limiting
  - Inbound requests per API (global/user/per-tenant)
  - Configurable refresh rates (multiple client considerations)

- Efficient Retry Patterns
  - Minimize dependencies in critical paths (client)
  - Audit failure handling in hot paths
    - 429 – retry-after
    - 500 – backout
Supporting the customer

- **Educate/How To?**
  - Social media, Youtube
  - Direct access to engineering
  - Local pilot schools with daily engineering calls

- **Diagnostics**
  - Unique configuration/environment
  - Problem definition
  - Collect logs

- **Importance of telemetry**
  - Focus on teacher scenarios
Incident Management

- Enhanced Incident Management Model
  - On-Call-Engineer + Declare Outage
  - Incident Manager (Sev2, Sev1)
  - Executive Incident Manager (Sev1)
  - Communications Manager

- Rotation changes
  - Double down on training OCE's
  - Switch from weekly to daily rotation
  - Allow enough breathing room between consecutive shifts for OCE

- Enrichments of incident reports to help OCE

- Defer all non-critical changes across all services

- Accelerate postmortem process and implementation of repair items

- Backup meeting/conference system

- Supplement monitors with auto-generated high severity incidents
  - Downdetector
  - Spike in customer tickets
Customer escalations

- **OCE Team 1 (Bellevue)**: 5:00 PM
- **IM (Bellevue)**: 5:00 PM
- **OCE Team 2 (Prague)**: 2:00 AM
- **Customer Support (Beijing)**: 9:00 AM
- **Comms Team (Texas)**: 7:00 PM
- **Customers (Japan)**: 10:00 AM
- **Customers (Australia)**: 2:00 PM
- **OCE Team 3 (Israel)**: 3:00 AM
Key Takeaways

- Don’t delay engineering debt/repair items.

- Missing any foundational mechanisms? Time to invest!

- OCE burn out is real and happens fast.

- (Enterprise != Education) && (In-Person < Remote)

- Gains here to stay (resiliency, COGS, scale, processes)