**Group: Certified Software Architects**

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**1. Current State of Digital Infrastructure**

Students and the community in Limehill face the significant challenge of having inadequate access to the internet and digital resources. The only reliance on a 2G/3G cell tower, which often provides a weak signal, is affecting platforms.   Compounding these issues, frequent load-shedding disrupts network access, further degrading connectivity due to the cell tower's limited backup power. The absence of public Wi-Fi zones exacerbates the digital divide, leaving students and residents with severely restricted access to the digital world.

**Existing low-bandwidth educational solutions globally**

* Edukite Learning App
* Ustad Mobile
* Radio and TV Broadcasts
* Vodacom e-School
* Rumie tablets
* Worldreader
* WhatsApp & Moya for text-based lessons.
* **Khan Academy Offline**

**Local Educational Requirements and Curriculum Needs**

* South African CAPS curriculum—digital learning must align with the Department of Basic Education’s framework.
* the curriculum be inclusive and flexible, catering to the needs of all learners (e.g. those with disabilities and those not proficient in the language of instruction)

**Available Technologies for Low-Connectivity Environments**

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| **Infrastructure & Connectivity Solutions** | **Hardware Solutions** | **Software & Content Solutions** |
| Mesh Networks | School Computer Labs (Offline Use Only) | Offline Learning Platforms—Kolibri |
| Community Wi-Fi Zones | Preloaded Tablets | YouTube Low-Data Mode |
| Low-Cost Data Plans | Raspberry Pi-Based Learning Hubs | Mobile-Based Learning—Eneza Education |
| 4G/5G Networks | Solar-Powered Devices (Tablets, power banks) | WhatsApp & Moya for text-based lessons. |
| Community Learning Centres with Local Network Setup |  | Google Classroom (Offline Mode) |
| Radio-based Learning |  | USB-based Content Distribution |
|  |  | Microsoft Office 365 (OneDrive and Teams) |

**2. Enterprise Architecture (EA) Model for Digital Education Platform**

1. **Capability Model**

* Offline Access to educational content
* Mobile Compatibility
* Periodic synchronization with cloud-based platforms
* Downloadable interactive lessons & quizzes.
* Low-Bandwidth Solutions
* Tools for teacher-student interaction and assignment submission
* Local Language Support

1. **Technology Architecture**
2. **Offline Capabilities**:

* Kolibri Servers: Local servers hosting educational content.
* Local Servers: Raspberry Pi devices or similar low-cost hardware.
* Content Distribution: USB drives or SD cards preloaded with educational materials.
* Download/Upload Mechanism: Students download content when connected and work offline.

1. **Mobile Access**:

* WhatsApp-Based Tutoring: Low-data platform for educational support.
* Mobile Compatibility: Accessible on smartphones and feature phones.

1. **Community Wi-Fi Zones**:

* Solar-Powered Hotspots: Reliable internet access in village centres.
* Central Locations: Hotspots placed in accessible areas for students and teachers.

1. **Mesh Network**:

* Local Resource Sharing: Schools share cached resources within the network.
* Efficient Distribution: Reduces dependency on external internet connections.

1. **Online Components**:

* Cloud Services: For content synchronization and updates.
* Mobile Networks: Leveraging 4G/5G networks for internet access.

1. **Data Architecture**
2. **Local Storage**:

* On-Device Storage = Educational content stored on local devices (e.g., tablets, smartphones).
* Local Servers = Centralized storage within the community for easy access.

1. **Cloud Synchronization**:

* Background Sync = Data synchronization occurs in the background when connectivity is available.
* Data Caching = Temporary storage of data to ensure smooth operation during connectivity interruptions.

1. **Application Architecture (Handling Intermittent Connectivity)**
2. **User Interface**:

* Responsive Design: Adapts to different devices and screen sizes.
* Intuitive Navigation: Easy-to-use interface for students and teachers.

1. **Offline Mode**:

* Preloaded Lessons: Content stored locally on devices.
* Local Quiz Submission: Quizzes completed and stored locally.
* Content Sharing: Applications like SHAREit or Xender for offline sharing.

1. **Intermittent Connectivity**:

* Auto-Save: Automatically saves progress.
* Sync Mechanism: Synchronizes data when connectivity is available.

1. **Multilingual Support**:

* Language Options: Content available in multiple languages.

1. **Accessibility Features**:

* Text-to-Speech: Converts text to spoken words.
* Screen Readers: Reads out content for visually impaired users.
* Voice-Based Navigation: Allows navigation using voice commands.

**Stakeholders**

* Students
* Teachers
* Government
* NGOs
* Parents
* Telecommunications companies

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| Constraints | Opportunities |
| * Limited internet access * Less internet connection in Limehill * High data costs * few computers in Limehill Village * Outdated mobile devices * No electricity in some houses and poor infrastructure of electricity * Less knowledge of students and teachers can’t use digital tools * Most content is offered in English * limited budget from government to fund the whole initiative | * Use of offline technologies like Khan Academy Lite and Eneza Education * Students will have access to digital educational resources, even in low-bandwidth environments. * Teachers can use technology into their teaching, enhancing the learning experience * Localized Content: Developing Content in Zulu * Students and teachers will develop digital skills. * The initiative will help bridge the digital divide between urban and rural areas. * Establish Community WI-FI Zones to benefit everyone * Regular device maintenance . |