# Infrastructure and Access Project Plans

OREGON DEPARTMENT OF EDUCATION
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## Project Planning

### A. Project—Mobile Cellular Hotspots

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| Installation Timeline: | 1-2 weeks; dependent on supply chain order fulfillment |
| Rough Cost Estimate: | $99-$300 per device up front; $12-$40 per month per device; bulk purchases available |
| Sustainability: | Subscription plans are 6-month minimum, up to 2 years. Moderate up front cost, but significant ongoing costs over the life of the subscription. Some education entities have reported a high device loss and breakage rate. |
| Pros: | Simple, manageable technology that can be "married" to district- owned computing devices and CIPA compliant. |
| Cons: | Must have adequate mobile cellular coverage to operate, with one or more providers; ongoing costs can be significant, Data limits are not conducive for educational use. |

**Additional Details:**

1. Consider regional or statewide enterprise contracts to help bring down costs.
2. Districts can use Title 1 funding transfer to support this option for students
3. School Bus Wi-Fi options exist at higher up front and ongoing costs.
4. Major providers include Verizon, Viaero, Kajeet, T-Mobile, etc.

**B. Project—Homework Hotspots at Community Anchor Institutions**

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| Installation Timeline: | 1-2 weeks |
| Rough Cost Estimate: | $200-$1,000 for initial microwave wireless equipment and wireless access point costs; $0 ongoing |
| Sustainability: | Shared internet access from school district to remote Homework Hotspot is limited only by what the school district is willing/able to share; no additional costs associated, and the school district cannot charge for sharing internet access, according to E-rate rules. |
| Pros: | Low cost, simple, straightforward wireless connection, with wireless access point at remote site managed as an extension of the school district's network. District-owned computing devices would connect automatically to the wireless access point. |
| Cons: | Rooftop to rooftop line-of-sight connections will not penetrate building or foliage obstructions. End users must drive from home to Homework Hotspot, which may be inconvenient or weather-dependent.<br>Supervision may be provided at the remote site. May require E-rate cost allocation for sharing internet with ineligible locations. |

**Additional Details:**

1. Libraries, hospitals, community centers, religious institutions, Extension offices, and postsecondary campuses are all possible options for school districts to sponsor Homework Hotspots.
2. Public libraries and school districts may apply for E-rate consortium status and then the equipment costs to interconnect the two locations would be eligible for E-rate under Category 1 and no E-rate cost allocation would be necessary.

**C. Project—Working with Local Internet Providers**

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| Installation Timeline: | 6 – 12 months to work out agreements for low-cost, non-subscription internet service to be offered to economically challenged families. |
| Rough Cost Estimate: | $10-$20/month |
| Sustainability: | Very sustainable. |
| Pros: | Provides a low-cost, pay-by-the-month, internet option for families that tend to be more mobile and/or who may have a deficient credit record and are unable to qualify for a service contract. |
| Cons: | May be limited to urban areas or larger service providers. |

**Additional Details:**

1. Providers may be reluctant to engage or embrace this service level offering as it represents a community service that will not generate positive revenue for the provider.
2. The advertisement of the "hidden" school district SSID address from residential and business subscribers, thereby enabling any Wi-Fi router to be a Homework Hotspot for district-owned student computers that are within range, is somewhat promising.

**Additional Details:**

1. Base Station
    a. Recommends four (4) 90-degree sector antennas, four TVWS radios, and exterior Power over Ethernet (PoE) cabling for each TVWS radio.
    b. Mounted at any height using a non-penetrating roof pedestal, bracket attached to the side of a building, utility mono-pole, metal tower; the higher the better.
    c. Must be located within 300' of the school's main switch for Ethernet access.
    d. May reach up to 9 miles, Non-Line-of-Sight (NLoS), and can penetrate foliage and buildings.
    e. Confined by the 6MHz channels granted by the FCC.
    f. Can deliver 25-30Mbps per directional sector antenna and TVWS base station radio, divided among the simultaneous users in that sector.

g. Budgeted equipment cost per Base Station = $1,800 - $2,000, depending on mounting hardware (installation is extra).
h. Realistic equipment cost per Base Station = $1,600-$1,750, for volume purchases
i. Maintenance options: 1 year up to 5 years
j. Annual cost of registry with the Nominet (https://usa.wavedb.com) Database of TVWS installations
k. Scaling statewide: 250 placements x $2,000 = $500,000

2. Customer Premise Equipment
   a. Consists of a 12" x 12" flat external antenna, external TVWS radio, PoE injector, and Ethernet cabling to the district's choice of an interior Wi-Fi router or Wireless Access Point (WAP).
   b. Antenna and TVWS radio mounted on a pole, side of house, or rooftop.
   c. Must be within 300' of the house's Wi-Fi router or WAP.
   d. Budgeted equipment cost per CPE = $500
   e. Scaling statewide: 10,000 CPEs x $500 = $5,000,000
   f. Installation represents an additional cost; 10,000 CPEs x ~$100/CPE = $1,000,000
   g. *Installation could be performed by commercial installers, with ownership of the student home equipment retained by the school district, and recovered if a student moves to an area that does have internet, graduates, or leaves the district.
3. Company Contacts
   Steve Rovarino, Red Rover LTD, steve@redroverltd.com; 408-921-8945
   Manufacturers: Adaptrum, Carlson Wireless, Radwind, Redline, 6Harmonics, etc.

**D. Project—Wireless Education Broadband Services (EBS) [2.5 Ghz]**

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| Installation Timeline: | 3-6 months to order/receive equipment + installation time for customized SIM card on every device. |
| Rough Cost Estimate: | $40,000-$50,000 for each set of core equipment per tower + $80-$250 Customer Premise Equipment (CPE) per student domicile. |
| Sustainability: | Core LTE equipment expected to last 4-5 years with firmware upgrades. Customer premise equipment and SIM cards can be managed as a storefront for potential subscribers. |

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| Pros: | Uses school district filtered internet. More complex, managed as a private 4G/LTE wireless network for fixed and mobile subscribers; would allow roving access by students to different towers. Bandwidth performance in the 25Mbps/5Mbps level. SIM card access can be enabled or disabled at the network administrator level. |
| Cons: | FCC licensing terms limit development to tribal lands unless public/private partnership is formed with commercial provider(s) who can apply for FCC licenses. Must have a source of fiber-based or microwave internet to each tower of 500-1,000Mbps. |

**Additional Details:**

1. Base Station
    a. Tower, pole, or pedestal placement with base station would be located on or near a school district source of the internet; the greater the height, the better.
    b. Must be located within 300' of the school's main switch for Ethernet access
    c. May reach up to 7 miles, near Line-of-Sight, and can penetrate minor foliage and buildings, but not appropriate coverage for valleys or ravines.
    d. Can deliver between 500Mbps and 1,000Mbps in 360 degrees radiated from the base station and shared by all the subscribers within that tower footprint.
    e. New EBS licenses to cover unserved areas are not available due to FCC ruling. A petition for reconsideration is pending.
    f. It may be possible to partner with a Wireless Internet Service Provider and subsidize their build-out to areas that they otherwise would not build, due to the lack of revenue/profit.
    g. Better to approach EBS as a county-wide or regional deployment with multiple towers to simulate a commercial grade mesh wireless network.
    h. Ongoing costs and maintenance are unprojected at this point.
2. Customer Premise Equipment
    a. Customer premise equipment ranges from $80 per unit for a MiFi hotspot to a high power external antenna for $250 per unit. The higher the cost, the longer the range from the base station, up to seven (7) miles.
    b. Each device (e.g. iPad, Chromebook, smart phone, etc.) will need a SIM card installed, and these cards cost up to $6 each for small quantities, and as little as $1 each in very large quantities.
    c. Other regional EBS networks in northern Michigan and California report that additional resources will be needed to provide technical support to the end users/subscribers.

**E. Project—Low Earth Orbiting (LEO) Satellite Service**

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| Installation Timeline: | 2-4 weeks after request for service is submitted online to receive equipment and installation on customer premises. |
| Rough Cost Estimate: | $100-$300 up front for equipment; ~$80-$100/month ongoing |
| Sustainability: | Long-term sustainability at comparable service levels of up to 100Mbps. |
| Pros: | Should be able to reach remote rural areas where no other broadband exists. High bandwidth speeds available with some providers at low latency. LEO service may be adaptable to moving vehicles. |
| Cons: | Major providers are still testing new satellite arrays and building up capacity for go-live service. Some services may have data limits. Customer costs may be higher than other service options. Service interruptions may occur during heavy rain or snow. Latency can be a problem. Not practical for municipal or dense population areas. |

**Additional Details**

1. Satellite service providers are found under the names: SpaceX-StarLink, TeleSat, OneWeb, Amazon-Kuiper, HughesNet, Viasat, DISH, Direct TV.
2. The more remote the subscriber and the lower the population density, the better the service.