Innovation journey of the Digital Earth Node (DEN): Experiences, ideas and future opportunities

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Abstract. There is an increasing need for readily-accessible virtual meeting spaces to connect decision-makers from different geographic locations and share spatial data for timely decision making. This paper presents the journey to date in pre-totyping and prototyping a Digital Earth Node’ (DEN) remote, immersive collaboration space to support learning, creating, and developing spatial capabilities, including the core one-touch “all-in” feature. It describes the innovative digital collaboration method that creates a high-trust, private and fast experience that makes accessibility of multiple data sets and monitors possible over low bandwidth mobile networks. This uncovers opportunities for field applications that include mobile vehicle data centres with modular mobile bandwidth leverage, creating a high redundancy network and large-scale collaboration offering. The authors discuss insights into improved decision-making and integrated policies, including the potential for programs that support engagement and collaboration between government, industry and academic researchers globally. The findings have implications to solve challenges from immediate disaster response and recovery, to planning for resilient communities, built environments and supporting infrastructure.

1. Introduction
With the advancement of digital and geospatial technology, everyone and everything in the world is connected [1]. Within this realm there is an increasing need for readily-accessible virtual meeting spaces to connect decision-makers from different geographic locations and share spatial data for timely decision making. Furthermore, there are significant drivers to manage the amount of air travel undertaken in the increasingly global workplace, spanning the reduction of greenhouse gas emissions, addressing security risks, and improving response times for disaster management and incident response. In this extended abstract, the authors overview the journey phases to date in creating remote immersive collaboration spaces in the form of ‘DENs’, and potential to address community-driven, cross-sectoral research to provide tangible, creative solutions for disaster management. The paper discuss insights into improved decision-making and integrated policies, including the potential for programs that support engagement and collaboration between government, industry and academic researchers globally. Essentially, DENs create spaces for people anywhere on the planet to connect and interact in high-trust environments, via low-bandwidth internet, feeling physically in the same space, and collaboratively working in real-time with information. The initiative spans four phases, with the first two complete and third underway as highlighted in the following sections.
2. Phase 1: Set Up (January 2017 – December 2017)
During this initial phase the authors sought to understand the problem and to secure funding to undertake the proof of concept. Beginning with a visit and keynote lecture to Griffith University by Chubu University’s Professor Fukui (January 2017), the research team worked on potential areas to apply this system and other research which could take place within this innovation, with resilience and post emergency management defined as key focus areas. In April 2017 the Griffith University team formed a connection with the International Society of Digital Earth (ISDE) and became a research node [2] as well as visiting the EU Joint Research Centre and Chubu University (two ISDE Chapter members). Engaging with end-user desires, Phase 1 involved creating a full-scale model of (preto-typing) the layout (Desha et al, 2018). Griffith University also created an MoU with Chubu University to pursue Digital Earth education and research going forward.

3. Phase 2: Proof of Concept Demonstration (January 2018 – July 2019)
In Phase 2, with University seed-funding and Industry in-kind contributions, the research team prototyped (fit-out) two Digital Earth Node ‘DEN’ rooms on Gold Coast and Nathan campuses, demonstrating the technology in March 2018. With end-user feedback the technology was then further refined to enable interaction with multiple screens using a mobile device with low bandwidth internet connection in contrast to high-powered computers with ultra-high bandwidth cabled internet connection. The resultant “all-in” one-touch feature (Q1 software) enables interaction where information is passed as event packets and data is not stored on servers. This digital collaboration method creates a secure, private and fast experience that makes accessibility of multiple data sets and monitors possible over low bandwidth mobile networks. This uncovered opportunities for field applications including mobile vehicle data centres with modular mobile bandwidth leverage, creating a high redundancy network and large-scale collaboration offering. The research team presented an update to the 2018 ISDE Conference [3] on the technology, and made a second visit to the European Joint Research Centre (ISDE Chapter Member). They presented the case study of the New South Wales Volunteer Rescue Association (NSW VRA) at the 2019 SSF Conference (Melbourne). The researchers also worked with Griffith University’s Digital Services to enable internet connectivity that meets security needs of education environments.

4. Phase 3: User Case Studies (August 2019 – December 2019)
In Phase 3, the research team are documenting user case studies as researchers and other academics within Griffith University use the two DEN facilities on Nathan and Gold Coast campuses. Through survey, interview and meta-data analysis of the room use information (gathered via the All-in platform), the facility will be evaluated for performance, to then address the feedback in anticipation of Phase 4.

5. Phase 4: External Connectivity & Deployment (January 2019 onwards)
The researchers will connect the two prototype rooms beyond the Griffith University security protection, to communicate externally in a secure manner. Future opportunities for collaboration include:
- Connecting directly with facilities and/orDENs in other ISDE chapters.
- Applying the technology as a mechanism to assist disaster and resilience management agenda in Queensland and elsewhere.
- Applying the technology as a future phase within the New South Wales Volunteer Rescue Association’s establishment.

The authors look forward to hearing from colleagues who are interested in exploring these or other future ideas as we progress on the DEN innovation journey.

References
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