

The Role of Interoperability In Advancing Integrated Care - Slaintecare

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CeIC is focused on Translation of Data

Models - Paper Based - Fax Machine -HIS

- Systems need to be redesigned to be patient centric for enabling care
- National compliance to adhere with standards and tools to accelerate ability to achieve infrastructure underpinned by mandatory requirements certifying compliance for interoperability
- OECD reports we are ranked last statistically. Ireland lags behind other countries in regards to key national health dataset availability, maturity and use <https://doi.org/10.1787/55d24b5d-en>

Information – Data- Digitalisation – AI/ML

- Must be based on FAIR data principles EU and EiF <https://www.eoscsecretariat.eu/news-opinion/achieving-interoperability-eosc-interoperability-framework>
- Requires **4** key elements:
 - Demonstrable health data use with better outcomes for all not just a select few
 - Building data infrastructure ensuring privacy and security
 - Building on existing successes
 - Rolling out patient-centric e-health services <https://www.digitaleurope.org/resources/a-digital-health-decade-from-ambition-to-action/>





Academia Role Summary Showcase in CeIC

- Microcredential for Interoperability
- Formalising information models with ontology schema using health informatics standards
- Building capacity, capability and confidence to ask the right questions on mature and evolving standards roadmap
- Formalising relationships with EU colleagues to adopt and adapt new science and standards
- Participating in standards revision and development ISO 13940 Consys work

Building Harmony Through Standards Mapping

Music



Structure

Defined Language in music

Symbols - describe how notes are written for comprehension Music has Notes, Keys - Style- Legato, Crochet Quaver

Library - e.g. iTunes provide access to music in a collective resource to browse

Instrument – Various tools used to create output music e.g. Violin

Record – Representation of sound in a form understood by humans to be an Instance of music e.g. Reel or a Jig

Computer Science

Infrastructure (Organisational and Facilities)



Language in Computer Science is defined

OWL 2 ontology language for the semantic web XML /RDF Includes structural elements explaining their roles and functionalities.

OWL2 has classes, properties, individuals, and data values

Library Informational Database

Graph DB holds information resources

<https://graphdb.ontotext.com/>

Tools like Protégé a plug in tool that can be adapted to build both simple and complex ontology based applications see https://arcg.is/1my9az_ and <https://github.com/> a development platform

Format In ontology uses a formal specification such as Description Logic (DL) that a computer can use based on a set of defined rules and relationships. For example ICNP is a defined classification and ontology which is based on a standard ISO 18104 Health informatics — Categorical structures for representation of nursing diagnoses and nursing actions in terminological systems

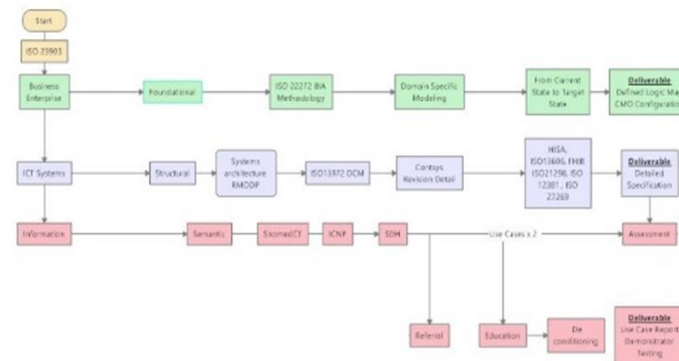
Formalising Networking Knowledge T/F



Knowledge Transfer community networks see Bernd Blobel's work Interoperability Layers

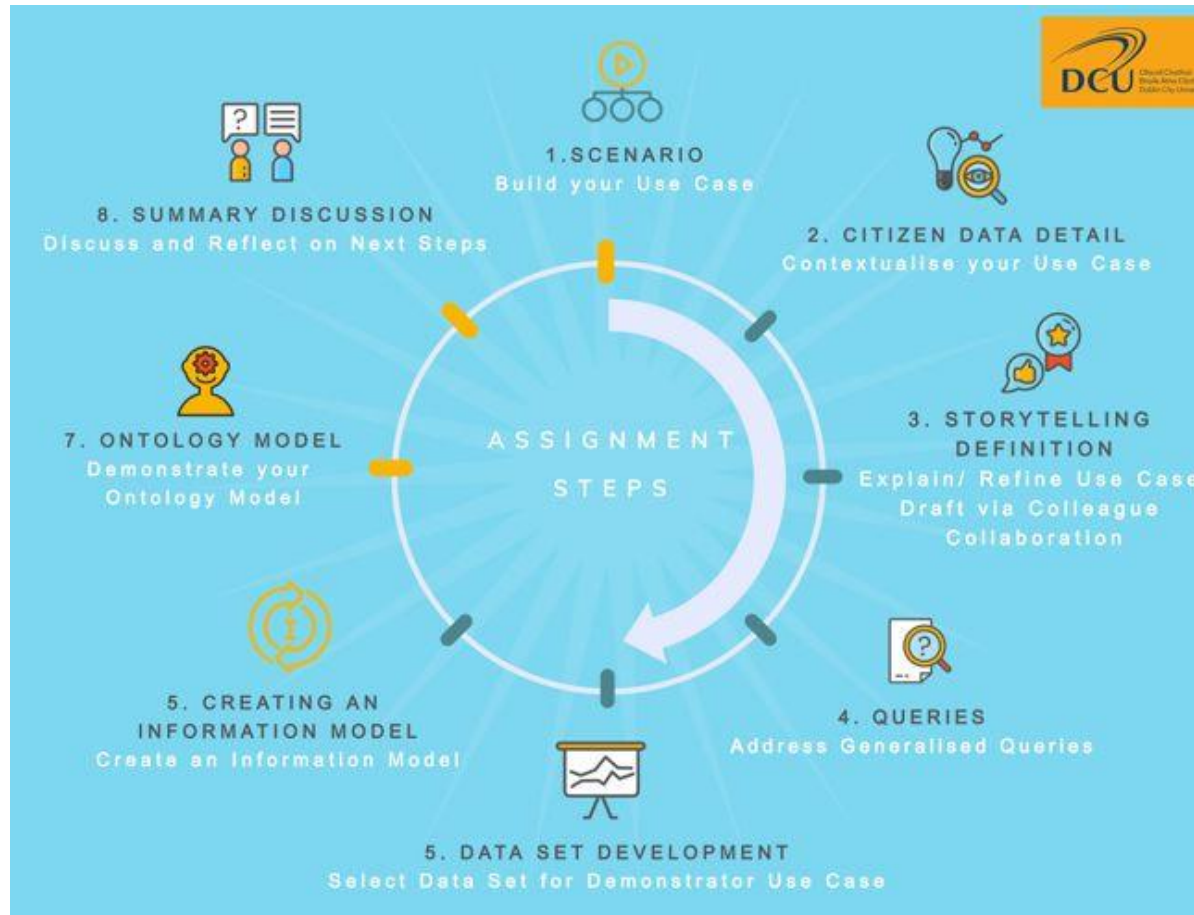
<https://efmi.org/user/bernd.blobel/>

Standards Roadmap different standards applied at different stages, processes, & contexts
Foundational
Structural
Semantic



We learn by doing - Education

Microcredential4Interoperability Key Steps



Example: Use Case Process

Centre for Integrated Care CeIC
Beta version of Sand Pit

Mary Jo Farrell
A 68 year old lady who lives alone in the community. She has osteoporosis and osteoarthritis.
[View Mary Jo](#)

Patrick Meagher
Pat is 73 years old and lives alone. Pat is supported by his neighbour who is formal care. Pat has Stage 2 Emphysema and requires home oxygen.
[View Patrick](#)

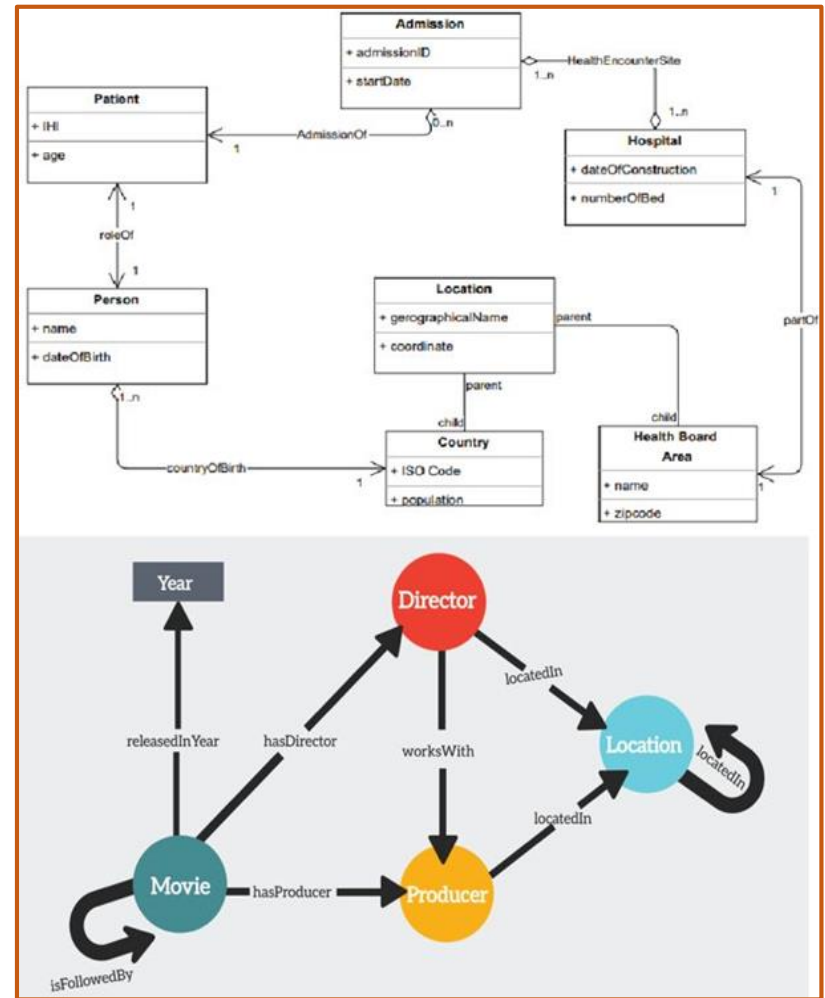
Una Dolan
Una is a single 79 year old lady who has had a stroke. Previously to this she lived independently and had no major health issues.
[View Una](#)

Breeda O'Reilly
A 64 year old lady who lives alone in the community. She has great support from her nieces and nephews who encourage to live independently. She has rheumatoid arthritis which is increasing in severity and is compromising her mobility.
[View Breeda](#)

Michael O'Brien
Michael is 61 years old and he lives in a residential unit in North Kerry. Michael has a mild to moderate intellectual disability - he has recently developed an irritable bowel disorder which requires further investigation.
[View Michael](#)

Sandra Thompson
Sandra is 40 years old and a severe intellectual disability with complex needs. She lives at home with her elderly parents. She has a Cru Du Chat syndrome. Her swallow is becoming weaker and she is having recurrent chest infections.
[View Sandra](#)

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From the patients story to a defined model and defined details 4 enabling care



Connecting Health And Social Care Using Smart Home Technology: The NEX Case Study



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23/05/22

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Development of an Internet of Things (IoT) technology platform (The NEX system) to support older adults to live independently: Protocol for a Development and Usability Study.

Timon CM¹, Heffernan E², Kilcullen S³, Lee H⁴, Hopper L³, Quinn J⁵, Mc Donald D⁶, Gallagher P³, Smeaton AF², Moran K⁷, Hussey P⁸, Murphy C⁸.

[Author information](#) ▼

Abstract

BACKGROUND: In a rapidly ageing population new and efficient ways of providing health and social support to older adults are required that not only preserve independence but also maintain quality of life and safety.

OBJECTIVE: The NEX project aims to develop an Internet of Things (IoT) integrated system coupled with Artificial Intelligence (AI) to offer unobtrusive health and wellness monitoring to support older adults to live independently in their home environment. The primary objective of this study is to develop and evaluate the technical performance and user acceptability of "The NEX system". The secondary objective is to apply machine learning algorithms to the data collected via the NEX system to identify and eventually predict changes in the routines of older adults in their own home environment.

METHODS: Methods: The overall NEX project commenced in December 2019 and is expected to be completed by August 2022. Mixed methods research (online survey and focus groups) was conducted with 426 participants including older adults (aged 60 and above), family caregivers, health care professionals and home care workers to inform the development of the NEX system (Phase 1). The primary outcome will be evaluated in two successive trials (the Friendly trial (Phase 2) and the ARC trial (Phase 3)). The secondary objective will be explored in the ARC trial (Phase 3)). For the Friendly trial, 7 older adult participants aged 60 years and above and living alone in their own homes for a 10-week period were enrolled in the trial. Thirty older adult participants aged 60 years and above and living alone in their own homes will be recruited for a 10-week data collection period (Phase 3).

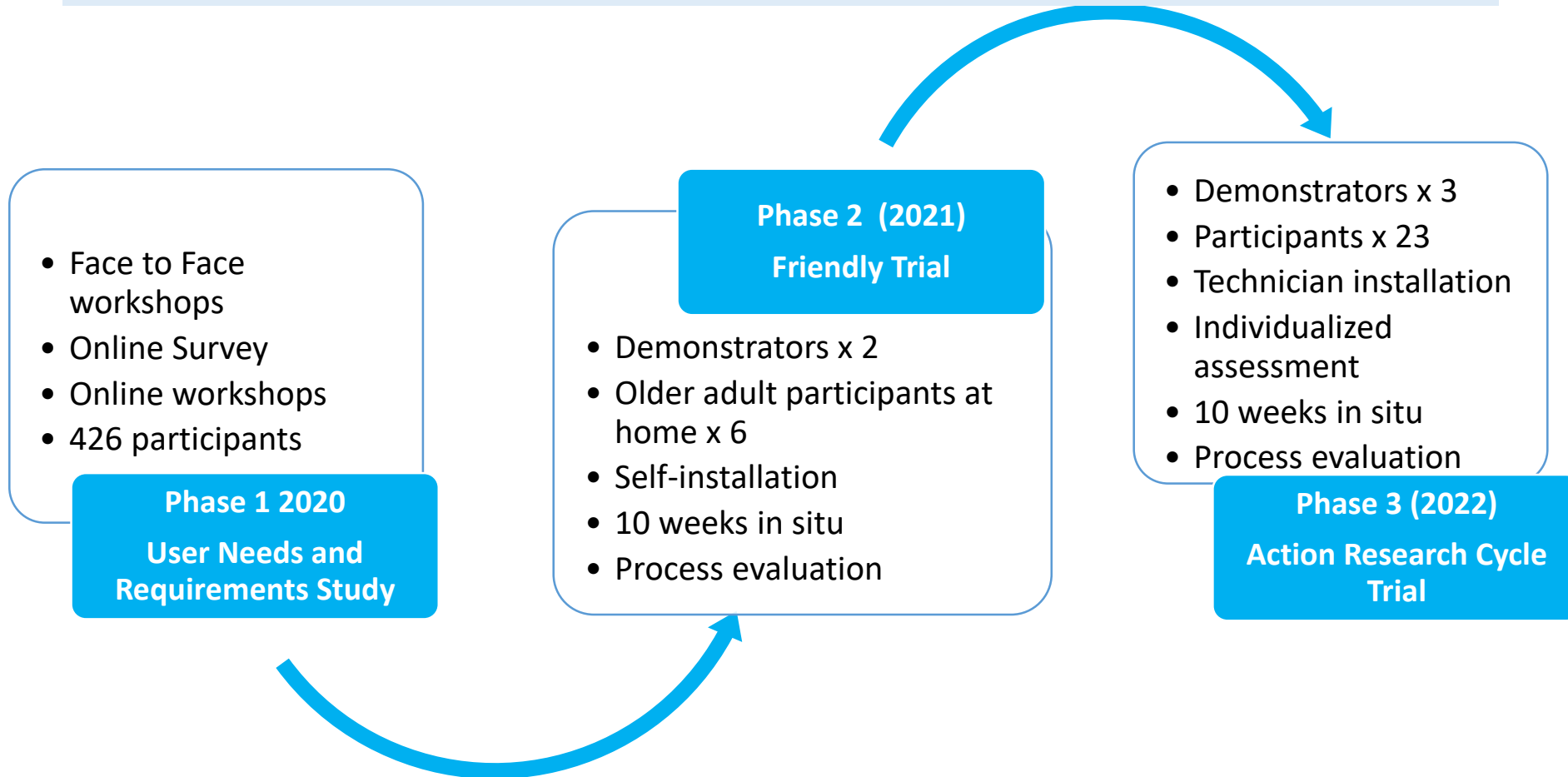
RESULTS: Phase 1 of the project (n=426) participants was completed in December 2020 and Phase 2 (n=7 participants for a 10-week pilot study) was completed in September 2021. The expected completion date for the third project phase (30 participants for 10-week usability study) is June 2022.

CONCLUSIONS: The NEX project has considered the specific everyday needs of older adults and other stakeholders which have contributed to the design of the integrated system. The innovation of the NEX system lies in the use of IoT technologies and AI to identify and predict changes in the routines of older adults. The findings of this overall project will contribute to the e-Health research agenda focusing on the improvement of healthcare provision and patient support in home and community environments.

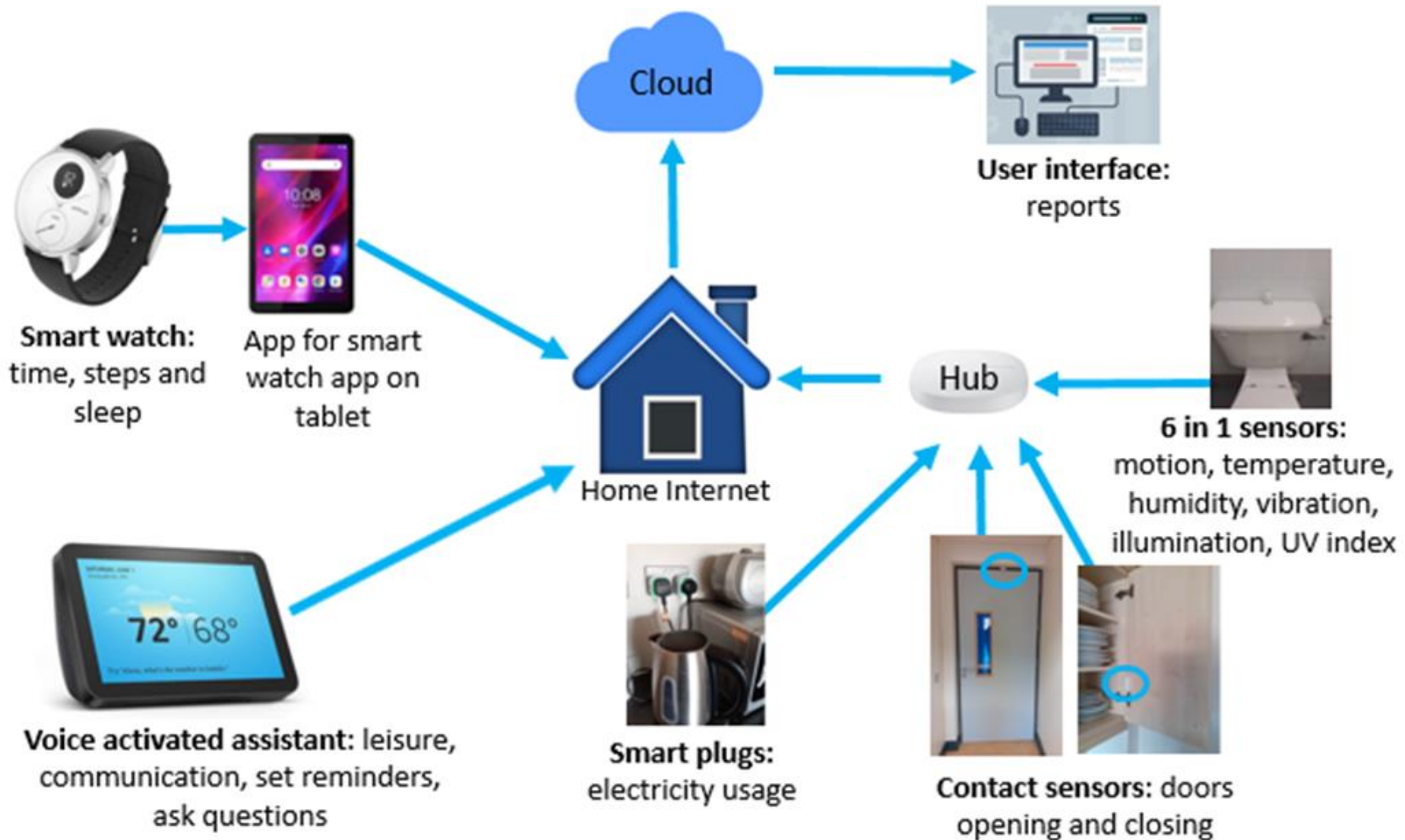
The NEX Project

Sláinte Care “Shift Left”: Home care, lifestyle, monitoring, far left space

Funding: Disruptive Technology Innovation Fund, Enterprise Ireland



The NEX System Components



The NEX System Raw Data

- Kitchen

Toaster - Aeotec Outlet

Kettle - Aeotec Outlet

Fridge - Aeotec Open/Closed Sensor

Cups Plates Bowls press - Aeotec Open/Closed Sensor

Condiment Press A left - Aeotec Open/Closed Sensor

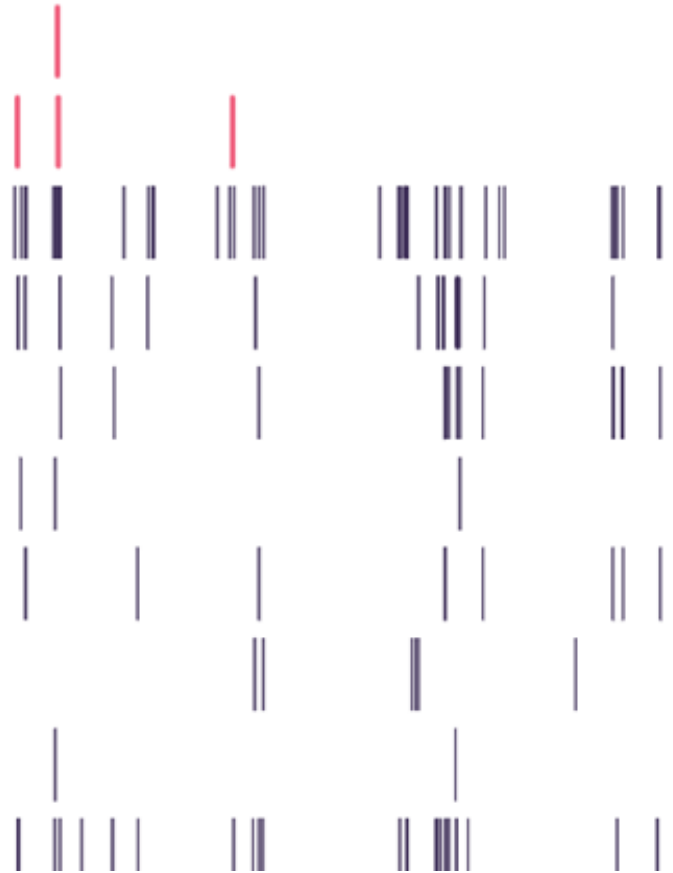
Staples Press A left - Aeotec Open/Closed Sensor

Condiment Press B right - Aeotec Open/Closed Sensor

Freezer - Aeotec Open/Closed Sensor

Staples Press B right Aeotec Open/Closed Sensor

Cutlery Drawer - Aeotec Open/Closed Sensor



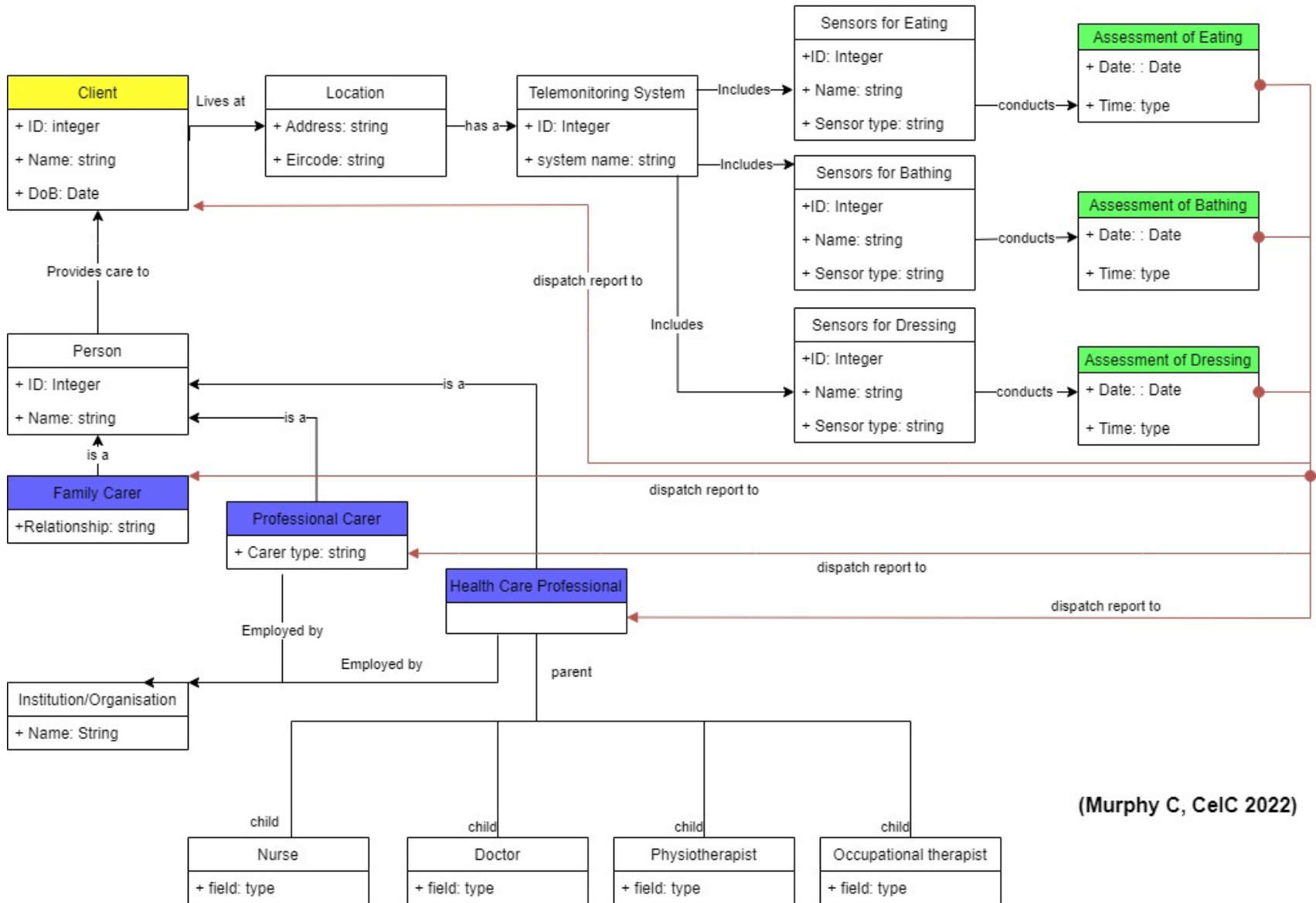
03:00 AM 06:00 AM 09:00 AM 12:00 PM 03:00 PM 06:00 PM 09:00 PM

Motion Device Usage Door Activity Open/Close Door Activity Open Door Activity Closed

Context of Use: Assessment of Activities of Daily Living

- Activities of daily living are a basic set of actions that involve caring for one's self and body, they include eating, bathing, dressing, mobilising and toileting
- Using the NEX sensor data the CeIC are working in partnership with INSIGHT to identify patterns of some ADLs
- Assessment of these ADLs is frequently used to determine support needs and this information is of interest to the older adults themselves, family carers and a wide range of health and social care professionals providing care in the community
- We aim to exchange this information across relevant health and social care systems. Our first step towards interoperability was to build an information model for NEX (next slide)
- Underpinned by a standardised language (SnomedCT in this example) this will enable lifestyle information to be shared consistently within and across health and social care settings

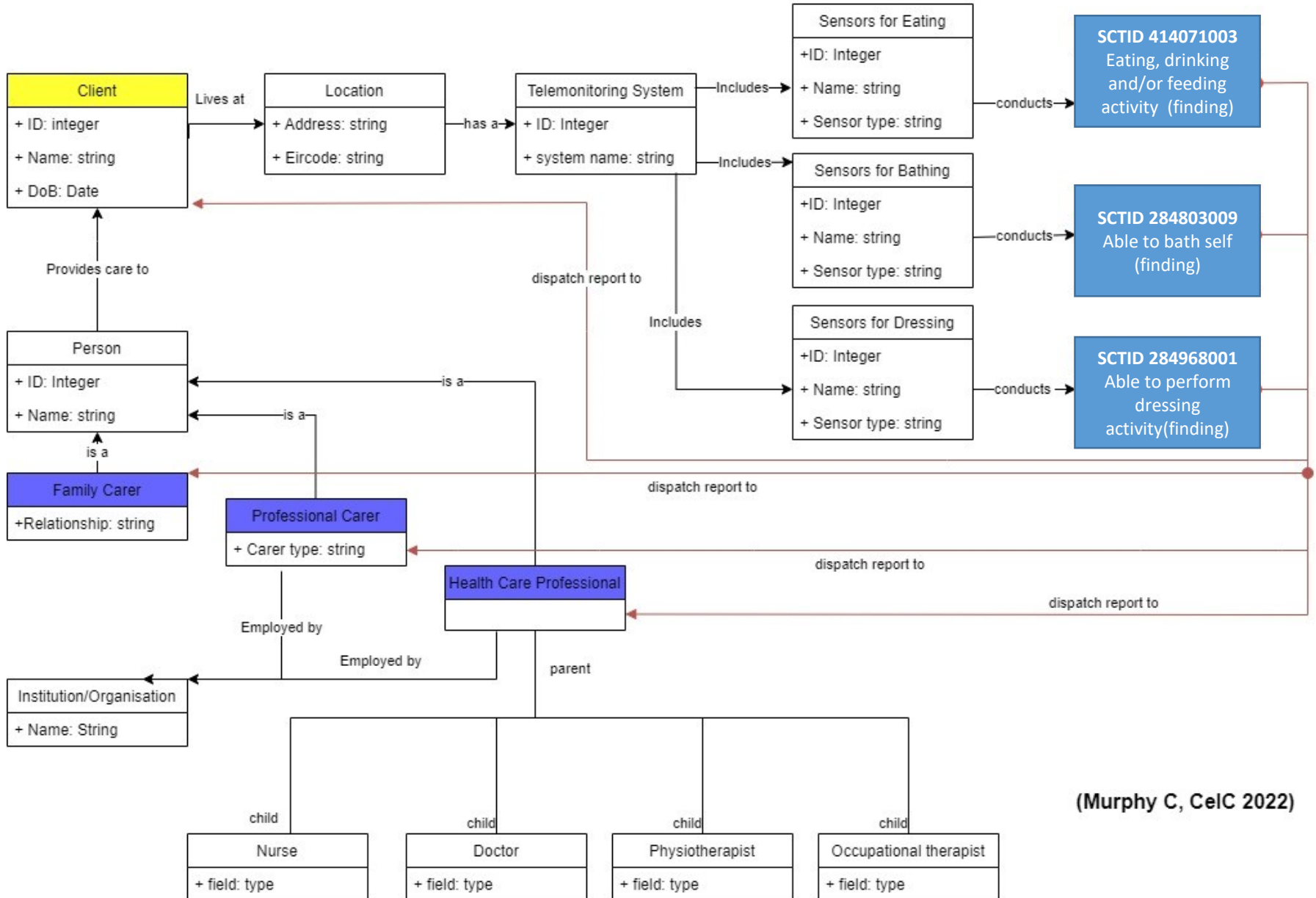
Informal information model for NEX system ADL monitoring



(Murphy C, CeIC 2022)

Informal model for NEX system ADL monitoring

Standardised Language



(Murphy C, CeIC 2022)

Thank You



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- NEX project website
<https://www.dcu.ie/ceic/nex>



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- Hussey P; Das S; Farrell S; Ledger L; Spencer A; (2021) 'Title A Knowledge Graph to Understand Nursing Big Data: Case Example for Guidance'. Journal of Nursing Scholarship, . [\[Link\]](#)
- Hussey P and Das S. A micro credential for interoperability [version 1; peer review: 2 approved]. Open Res Europe 2021, 1:109 (<https://doi.org/10.12688/openreseurope.14083.1>)
- Timon CM, Heffernan E, Kilcullen SM, Lee H, Hopper L, Quinn J, McDonald D, Gallagher P, Smeaton AF, Moran K, Hussey P, Murphy C Development of an Internet of Things Technology Platform (the NEX System) to Support Older Adults to Live Independently: Protocol for a Development and Usability Study JMIR Res Protoc 2022;11(5):e35277 doi: [10.2196/35277](https://doi.org/10.2196/35277) PMID: [35511224](https://pubmed.ncbi.nlm.nih.gov/35511224/)
- Das, S ;Hussey, P. (2022) 'Development of an Interoperable-Integrated Care Service Architecture for Intellectual Disability Services: An Irish Case Study' In: Eai/Springer Innovations In Communication And Computing. [\[Link\]](#)
- See website for additional publications online www.ceic.dcu.ie