

Secure and Efficient Data Spaces

Y. Thomas, I. Pittaras, F. Bistas, K. Mantaraki, George Xylomenos
MMLab, Athens University of Economics and Business

Christos Papadopoulos
University of Memphis

<https://mm.aueb.gr/>

Alignment



Motivation for work

- ETSI Data Spaces: a new form of digital platform
 - Liberates data from silos
 - Enables data-driven innovation
 - Shapes digital transformation
 - Offers NGSI-LD API for queries
- SNDS project (NGI Sargasso OC1)
 - Prototyped Data Space over NDN
 - Fully distributed and self-sovereign identity system
 - Outperformed traditional IP-based networks

Project goals

- SeEDS: Implement a full Data Space over NDN
 - Required + Optional data API operations
 - Content filtering based on conditions
 - Temporal queries over timestamped data
 - Subscriptions to data events
 - In-network security and privacy
 - Data integrity verification
 - Selective content revelation
 - Enhanced efficiency
 - Distributed data intermediaries
 - Migration of content filters

Alignment with call

- Challenges
 - C1: Sustainable Digital Infrastructure
 - Migration of filters to content
 - C4: Enhanced Data Security and Privacy
 - Trusted filtering agents
 - C6: Decentralised Technologies
 - Fully decentralized data intermediary
- Areas of knowledge
 - Trust, Data sovereignty, Digital identity
 - Fully decentralized security solution based on DIDs

Excellence

NGI

ΟΙΚΟΝΟΜΙΚΟ
ΠΑΝΕΠΙΣΤΗΜΙΟ
ΑΘΗΝΩΝ



ATHENS UNIVERSITY
OF ECONOMICS
AND BUSINESS



THE UNIVERSITY OF
MEMPHIS

Objectives

- Build an ETSI-compliant data space over NDN
 - Expand prototype from NGI Sargasso OC1 SNDS
- Rich query-based content retrieval API
 - Improve privacy by hiding content names
- Security scheme based on self-sovereign DIDs
 - Privacy-preserving content and integrity protection
- Reuse of NDN codebase and validation in NDN testbed
 - Open-source data space implementation for NDN

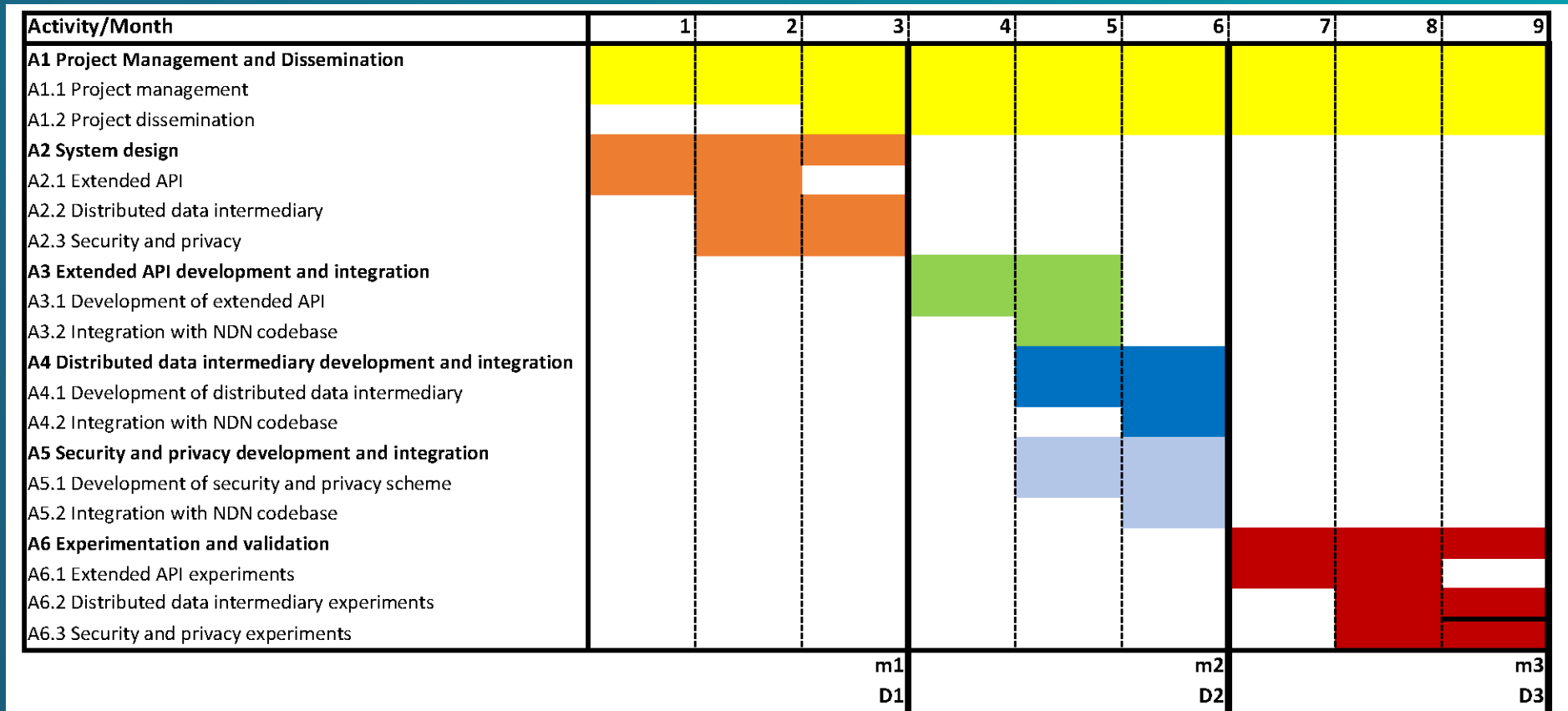
Innovation

- Bring together diverse NGI technologies
 - ICN/NDN: standardized in the IETF ICNRG
 - DIDs: standardized by W3C CCG and DIF
 - Data Spaces: collaboration with FIWARE and iSHARE foundation
- Progress beyond previous projects
 - NGI Sargasso OC1 SNDS
 - Complete ETSI Data Spaces implementation
 - Fully decentralized, more flexible, more efficient
 - NGIAtlantic.eu SCN4NDN/SECOND
 - Extensions to NDN, testing in NDN testbed

KPIs

- KPI 1: Implementation of the full NGSI-LD API
 - Target: at least one temporal and one content filtering constraint per query
- KPI 2: Efficiency of in-network security mechanisms
 - Target: No disruption when up to 50% of requests originate from malicious users
- KPI 3: Efficiency of distributed data intermediary
 - Target: Less than 200 ms to recover with 50% of data intermediaries failing
- KPI 4: Validation of full prototype over worldwide NDN testbed
 - Target: Experiments including at least 3 nodes in 3 continents
- KPI 5: Release an open-source prototype implementation
 - Target: At least 5 stars in the public repository on GitHub
- KPI 6: Submission of papers in international conferences / workshops
 - Target: Submit at least two papers by the end of the project

Plan



- Three deliverables and an open-source repository

Collaboration

- Athens University of Economics and Business
 - MMLab: leader in ICN and Digital Identities
 - Design, implementation, integration, experiments
- University of Memphis
 - Core contributors to NDN design and implementation
 - Consulting on all aspects, help with NDN testbed
- Monthly remote meetings
 - Progress reports and reviews

Impact



Impact on partners

- AUEB and UM are both active in ICN/NDN
 - AUEB contributes experience with digital identities
 - UM contributes experience with NDN implementation
- Long running collaboration on such projects
 - Same partners in NGI Sargasso OC1 SNDS
- SeEDS will benefit both
 - UM will exploit digital identities on its vehicular NDN program
 - AUEB will extend NDN with ETSI NGSI-LD API

Economic impact

- Who would be interested in SeEDS?
 - Anyone who has lots of sensitive data
 - Health providers, insurance companies, wearable vendors, etc...
 - Currently: build your own cloud, or rely on large corporations
- Benefits from SeEDS
 - Open-source: no proprietary code, no vendor lock-in
 - Open API: can use different data intermediaries
 - Decentralized: relies on DIDs, no need for expensive PKIs
 - Secure: can check individual packets, access control via DIDs
 - Private: no exposure of content names, selective content revelation

Environmental & social impact

- Content distribution greatly affects the environment
 - CDNs and social networks move data across large distances
 - SeEDS moves functionality inside the network
 - Rich API with temporal and content filtering capabilities
 - Content filter migration to the most appropriate place
- SeEDS hardens and extends NDN's security and privacy
 - Data Spaces address EU's privacy and security concerns
 - DIDs are critical to decentralization on the Internet at large
 - SeEDS will give control of data back to its creators/owners

Community impact

- Active presence on standardization groups
 - AUEB participates in W3C and DIF identity groups
 - AUEB and UM participate in IETF and NDN meetings
- Project results will be publicly available
 - Preprints will be published on Arxiv
 - Code on public repository with open-source license
 - NDN is already open source
- Participation on NGI community events
 - Exploitation of opportunities NGI Sargasso will offer
 - Focus on events on ICN/NDN and Digital Identities

Thank you

<https://mm.aueb.gr/>

