

# A DECENTRALISED AUTONOMOUS COMMUNITY IN SPACE

## SPACE IS GETTING BUSIER!

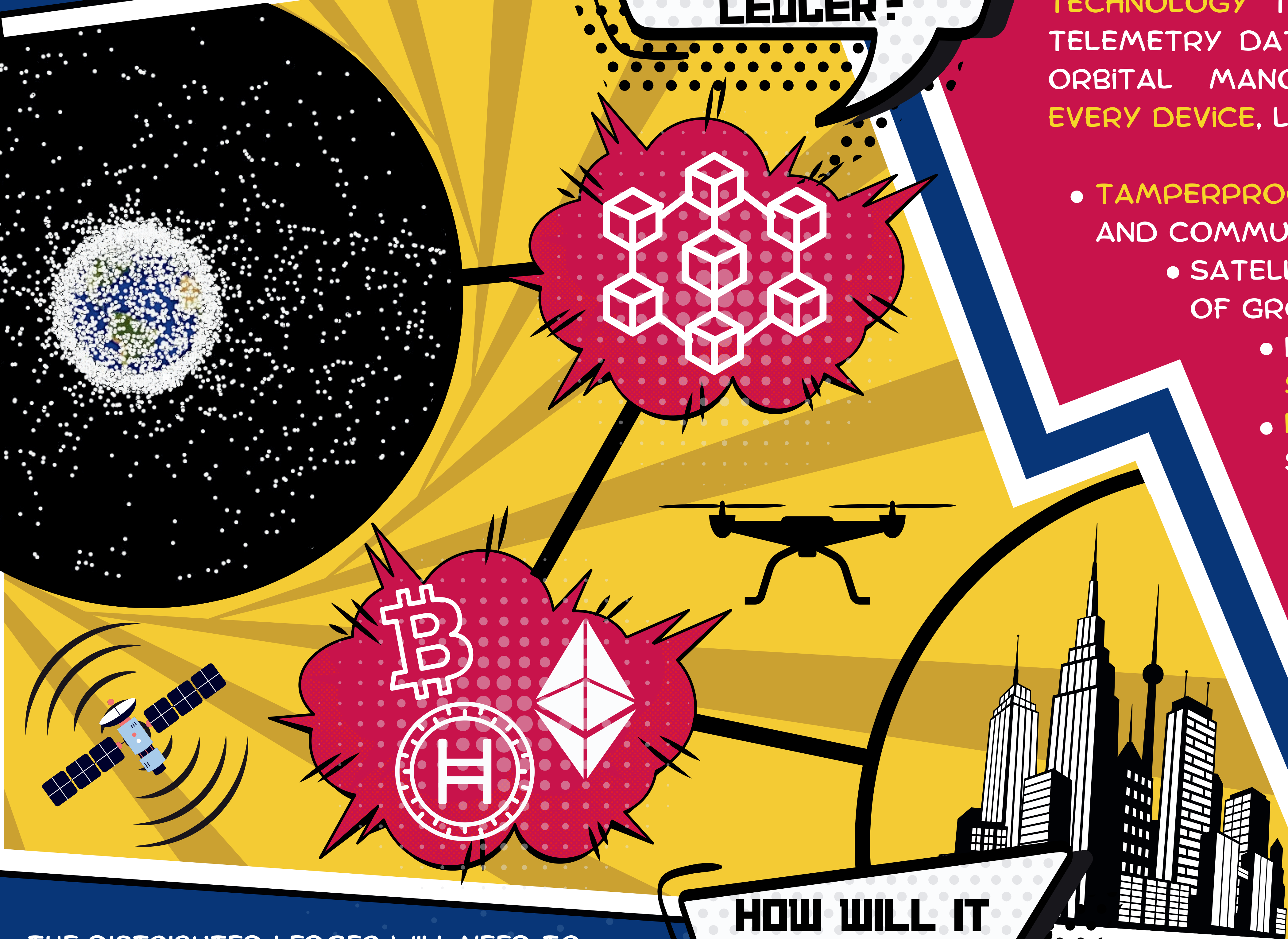


THE NUMBER OF SPACECRAFT IN LOW-EARTH ORBIT WILL CONTINUE TO GROW OVER THE COMING DECADES. AS THESE SPACECRAFT BECOME INCREASINGLY INTERCONNECTED, THEY WILL EVOLVE INTO AN **INTERNET OF THINGS (IOT) SENSOR NETWORK**. THIS PROJECT AIMS TO TRANSFORM THIS NETWORK INTO A **DECENTRALISED AUTONOMOUS COMMUNITY IN SPACE (DACS)**, GOVERNED BY A DISTRIBUTED LEDGER WITHOUT CENTRALISED CONTROL. THIS ENABLES **AUTONOMOUS, COORDINATED COLLISION AVOIDANCE MANOEUVRES** USING SMART CONTRACTS, WHICH ENHANCES SAFETY AND SUSTAINABILITY IN SPACE. THE PROJECT IS CURRENTLY **EVALUATING DISTRIBUTED LEDGER TECHNOLOGIES** TO DETERMINE THEIR SUITABILITY FOR USE IN A SPACE-BASED, TIME-VARYING NETWORK.

### WHAT IS A DISTRIBUTED LEDGER?

THE DACS FRAMEWORK USES **DISTRIBUTED LEDGER TECHNOLOGY** TO ENABLE SATELLITES TO POOL THEIR TELEMETRY DATA, EPHEMERIS DATA AND RECORDS OF ORBITAL MANOEUVRES, **SYNCHRONISING IT ACROSS EVERY DEVICE**, LEADING TO:

- **TAMPERPROOF AND TRANSPARENT DATA STORAGE AND COMMUNICATION**
- **SATELLITES COMMUNICATING INDEPENDENTLY OF GROUND PERSONNEL**
- **IMPROVED NETWORK RESILIENCE AND SECURITY**
- **INCENTIVES FOR OPERATORS THAT SHARE THEIR DATA**
- **AUTOMATION AND COORDINATION IN REAL-TIME**



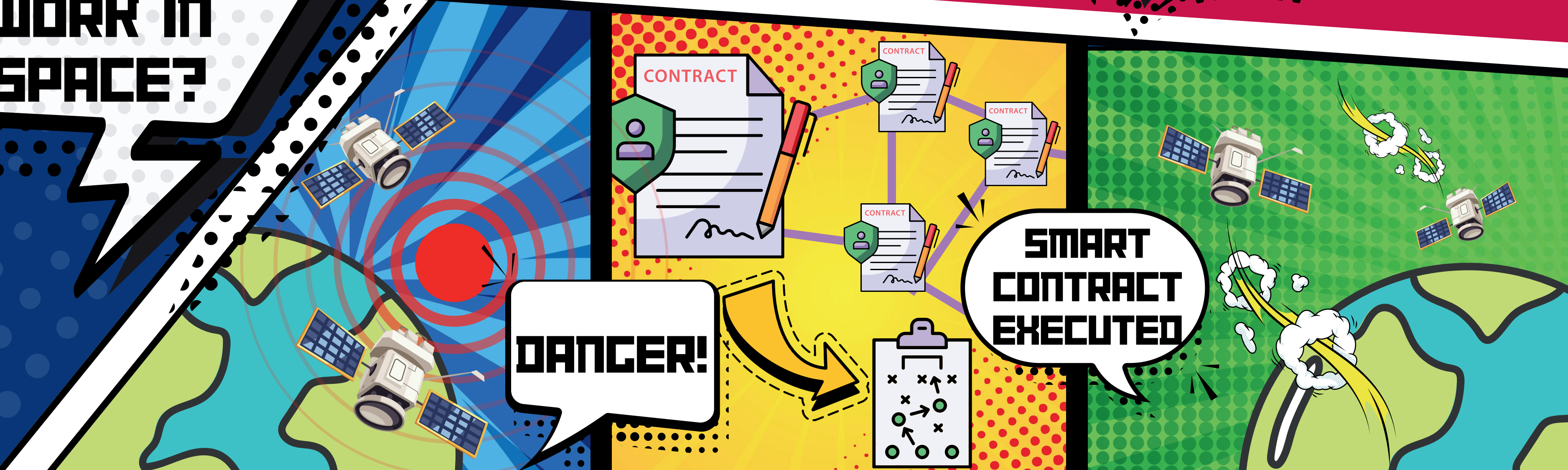
### HOW WILL IT WORK IN SPACE?

THE DISTRIBUTED LEDGER WILL NEED TO **OPERATE ON SATELLITES IN ORBIT**, SO IT MUST BE:

- **COMPUTATIONALLY LIGHTWEIGHT** TO BE ABLE TO RUN ON LOW-POWER ONBOARD COMPUTERS.
- **BYZANTINE FAULT TOLERANT**, AS NOT EVERY ENTITY CAN BE TRUSTED.
- **SCALABLE**, TO HANDLE LARGE AMOUNTS OF DATA.
- **ABLE TO REACH CONSENSUS ASYNCHRONOUSLY**.

THIS CAN BE ACHIEVED BY ADAPTING THE LEDGER'S **CONSENSUS MECHANISM AND ARCHITECTURE**, AND LEVERAGING THE **PHYSICAL PROPERTIES OF SATELLITE CONSTELLATIONS**.

**DIRECTED ACYCLIC GRAPHS (DAGS)** AND **BLOCKCHAIN SHARDING** ARE EMERGING DLT ARCHITECTURES, FOCUSED ON IOT APPLICATIONS WITH HIGH DATA THROUGHPUT AND LOW LATENCY.



**SMART CONTRACTS** ARE PROGRAMMED INTO THE LEDGER AND WITNESSED BY ALL NODES. EXECUTION OF THE CONTRACT OCCURS AUTOMATICALLY WHEN DATA SHOWS THE CONDITIONS, **SUCH AS BREACHING A THRESHOLD SEPARATION DISTANCE** ARE MET. THESE CONTRACTS CAN RESULT IN **MACHINE-TO-MACHINE TASKING** BETWEEN SPACECRAFT, REDUCING RELIANCE ON THE GROUND, ENABLING **DYNAMIC, REAL-TIME RESPONSE TO EVOLVING RISKS** IN ORBIT, AND CREATING OPPORTUNITIES FOR NEW SPACE-BASED SERVICES TO EMERGE.