

# The Agrinet

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## 1. Purpose

Agrinet connects diverse agricultural stakeholders through a comprehensive global communications network, enabling efficient collaboration across the entire agricultural value chain

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## 3. Intended Users

- The Agrinet is for public or private use under the licensing agreement above, and intended to facilitate connectivity in terraforming or homesteading tech stacks
  - Users will need to use a functional UI to interact with the Agrinet
- 

## 4. Transmissions

### 4.1 Recursion Formatting

All portions of transmissions are separated by "/"

- key1\_[key]/key2\_[key]/user\_interface\_string

All transmissions are ended with: /over

- key1\_[key]/key2\_[key]/user\_interface\_string/**over**
-

## 4.2 User Interface Recognition

All transmissions to the Agrinet must begin with a user interface's active key string. All other transmissions are directed to the user interface registration prompt.

### 4.2.1 User Interface Registration Prompt:

#### 4.2.1.1 UI Title

- "Fruitful"

#### 4.2.1.2 UI String

- "Fruitful\_app"

#### 4.2.1.3 UI Description

- "Fruitful is the Network Theory Applied Research Institute's official user interface for the Agrinet"

#### 4.2.1.4 UI Operator

- "the Network Theory Applied Research Institute Inc"

#### 4.2.1.5 UI Operator Email

- "[info@ntari.org](mailto:info@ntari.org)"

#### 4.2.1.6 UI Operator Phone

- "+1 502.885.1367"

#### 4.2.1.7 UI Language

- "English"

#### 4.2.1.8 UI URL

- "<https://ntari.org/fruitful>"

#### 4.2.1.9 User Interface Contract Agreement

XYZ

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### 4.2.2 Authentication

- The user's email address and phone shall be verified by standard 2FA before their data is added to the UI Database
- Each UI will have its own file where user data and transaction records will be stored

- Duplicates are rejected
- 

#### 4.2.2.1 UI Testing

The following tests must be passed by the UI in order to proceed and be added to the UI database

1. Test Key dialog
    - a. Issue 5 mock keys with 3, 6, 9, 12, and 365 transmission expirations
    - b. Use key one on test 2-X
    - c. Use key two on test X-X
    - d. Use key three on test X-X
    - e. Use key four on test X-X
    - f. Use key five on test X- issue market requests until expired
- 

#### 4.2.2.2 UI Database

Holds registration and user information for each user interface

- Agrinet:/fruitful\_app
- 

### 4.2.3 Key Issue

Successfully authenticated user interfaces are allowed access to the key library

#### 4.2.3.1 Key Library

- Populated with keys produced by a McEliece cryptosystem (see attachment)
  - Associates 7 keys with a new user interface
  - Issues associated keys to user interface for key dialog
  - Maintains 7 key associations per UI during dialog
    - Expiration variables counted by transmission
    - Each key has random expiration variables of 3, 6, 9, 12, and 365
  - Expired keys remain in the library until they are attempted once after their expiration. At that exchange, the key will automatically be swapped for another and the expired key deleted
- 

#### 4.2.3.2 QC-MDPC McEliece Module

Preloads and maintains 14 keys in the library without UI associations.

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#### 4.2.3.2.1 Key Generation Process

##### 4.2.3.2.1.1 Parameter Selection

Begin by selecting appropriate parameters:

$n_0$ : The size of each cyclic block (typically a prime number)

$w$ : The row weight (number of 1s in each row of the parity-check matrix)

$t$ : The error-correction capability

For example, common parameters might be  $n_0 = 4801$ ,  $w = 90$ ,  $t = 84$  for a 128-bit security level.

---

##### 4.2.3.2.1.2 Construct the Private Key ( $H$ )

The private key is a parity-check matrix  $H$  in the form  $[H_1 \mid H_2]$ , where:

- $H$  is a sparse binary matrix of size  $r \times n$ , where  $r = n_0$  and  $n = 2n_0$
- Both  $H_1$  and  $H_2$  are quasi-cyclic matrices of size  $n_0 \times n_0$
- Each row has exactly  $w$  non-zero elements (1s)
- $H_1$  is designed to be invertible over  $GF(2)$

The quasi-cyclic property means each block is defined by its first row, as each subsequent row is a cyclic shift of the previous row. This property dramatically reduces the storage requirements. For example, to generate  $H_1$ :

Randomly select  $w/2$  positions in a vector of length  $n_0$

Set these positions to 1, all others to 0

Generate the full matrix by cyclic shifts of this row

$H_2$  is generated similarly, but doesn't need to be invertible.

---

##### 4.2.3.2.1.3 Derive the Public Key ( $G$ )

Derive the Public Key ( $G$ )

The public key  $G$  is generated as follows:

Compute  $Q = (H_1^{-1} \times H_2)$  over  $GF(2)$

The public key is  $G = [I \mid Q]$ , where  $I$  is the identity matrix of size  $k \times k$  ( $k = n - r$ )

Due to the quasi-cyclic property,  $Q$  is also quasi-cyclic, meaning we only need to store its first row. This is what enables the dramatic reduction in key size.

---

##### 4.2.3.2.1.4 Generate Decoding Information

Generate Decoding Information



For efficient decoding during the decryption process, we need:

The parity-check matrix  $H$

An efficient LDPC (Low-Density Parity-Check) decoding algorithm

The bit-flipping algorithm is commonly used for decoding, which exploits the sparse nature of  $H$ .

---

#### 4.2.3.2.1.5 Example with Simplified Parameters

Let's walk through a simplified example with toy parameters (in practice, much larger values are used):

1. Select parameters:  $n_0 = 31$ ,  $w = 8$ ,  $t = 7$
  2. Generate  $H_1$ :
    - Randomly select 4 positions (e.g., 2, 10, 17, 25) in a vector of length 31
    - Set these positions to 1, creating the first row:  
(0,0,1,0,0,0,0,0,0,1,0,0,0,0,0,0,1,0,0,0,0,0,0,1,0,0,0,0,0,0,0)
    - Generate the full  $H_1$  by cyclically shifting this row 30 times
  3. Generate  $H_2$  similarly with 4 different positions
  4. Ensure  $H_1$  is invertible over  $GF(2)$
  5. Compute  $Q = H_1^{-1} \times H_2$
  6. The public key is  $G = [I \mid Q]$ , which can be represented by just the first row of  $Q$  (31 bits)
- 

## 4.3 Key Dialog

### 4.3.1 Key string

Any two of the seven keys in a UI's possession must be broadcast sequentially

- `key1_"key"]/key2_"key"/`
- 

### 4.3.2 Verification Sequence

- The first key is checked and swapped if necessary (see 4.2.3.1 Key Library)
  - The second key is checked and swapped if necessary (see 4.2.3.1 Key Library)
- 

### 4.3.3 UI Declaration

Key strings should be followed by the UI string

- `key1_"key"/key2_"key"/fuitful_app/`
-

#### 4.3.3.1 Mismatched Keys?

If key associations do not match the UI string the terminal attempting entry will be locked out until customer service is contacted

---

### 4.4 User Recognition

The next portion of the transmission should provide the user's identification. If the user is not recognized, the user interface must register the user:

- key1\_"key"/key2\_"key"/fruitful\_app/geoLat\_17.18113,  
geoLong\_-48.11553/Usrn\_Fruitful1/email\_fruitful1@gmail.com/phn\_+15028851367/
- 

#### 4.4.1 User Registration

- Geolocation for declared home address
  - Username
  - Email (verified by UI)
  - Phone (Verified by UI)
- 

#### 4.4.2 User Data Storage

This data is added to UI Database

- Agrinet:/fruitful\_app/username
- 

### 4.5 Transmission Sorting

#### 4.5.1 Dialog Recorder Module

- Merges posts with associated transaction, message, update and PING data
- Sends data to the Mycelium database when prompted by the Transaction Module

##### 4.5.1.1 Open Dialog Database

- Hash incoming and outgoing transmission ID data
- Associate IDs by post ID references

##### 4.5.1.2 Mycelium Database

- Assemble hashed data in the following order:
  - Post ID
  - Transaction ID(s)
  - PING ID(s)

- Update ID(s)
  - Messages
- Rehash data onto permanent blockchain

## 4.5.2 Market Broadcast Request

- Activates the General Broadcast Module, displaying network products and services by geolocation

### 4.5.2.1 Market Broadcast Request Formatting

Market access requests activate the General Broadcast Module

- key1\_”key”/key2\_”key”/fruitful\_app/geoLat\_17.18113, geoLong\_-48.11553/Usrn\_Fruitful1/email\_fruitful1@gmail.com/phn\_+15028851367/**mbr/over**
- 

#### 4.5.2.1.2 General Broadcast Module

- Packages output from connected modules and broadcasts to the user interface

##### 4.5.2.1.2.1 *Geolocation Filter*

- This is the main output of the broadcast module, providing information on posts with geographic priority
- 

##### 4.5.2.1.2.2 *Translation Service*

- Provides automated machine translation if UIs have different declared languages
- 

##### 4.5.2.1.2.3 *Calendar Interface*

- Allows users to view PING records and schedule
- 

##### 4.5.2.1.2.4 *Map Interface*

- Allows users to view production points on an interactive map
- 

##### 4.5.2.1.2.5 *Technology Tree*

- [AGRIS Open Data Set](#)
- [Agrontology](#)
- [AGROVOC Multilingual Thesaurus](#)

## 4.5.3 Post Transmissions

- Adds a network product or service to general broadcast data

#### 4.5.3.1 Service Post Format

##### EXAMPLE:

key1\_"key"/key2\_"key"/fruitful\_app/geoLat\_17.18113,  
geoLong\_-48.11553/Usrn\_Fruitful1/email\_fruitful1@gmail.com/phn\_+15028851367/srvcpst/**t=Fruitful\_Planning/c=la-pa/d=Planning\_and\_advising\_by\_the\_creators\_of\_the\_Agrinet!/med:1.mp4-2.jpg-3.jpg-4.jpg-5.jpg/term=\$120 month\_other\_terms\_and\_conditions\_apply/over**

- This example lists a service called "Fruitful Planning" in the labor category, described as "Planning and advising by the creators of the Agrinet!" It has five media attachments (an MP4 and four JPG) and terms are defined as \$120 a month with other terms and conditions.
- **Title** indicated by a "t"
- **Category** indicated by "c"
  - **Labor** indicated by "la"
    - **Planning/Advising** indicated by "pa"
    - **Setup/Maintenance** indicated by "sm"
    - **Planting/Harvest** indicated by "ph"
  - **Logistics Range** indicated by "lr"
    - <10 km
    - >10 km
    - >20 km
  - **Processing** indicated by "pr"
    - **Home-based/ Cottage Food** indicated by "hb"
    - **General Processing** indicated by "p"
    - **Animal Processing** indicated by "ap"
  - **Composting/Recycling** indicated by "cr"
  - **Environmental Services** indicated by "es"
- **Listing Range** indicated by "lr"
- **Description** indicated by "d"
- **Media file (up to 5)** indicated by "med:"file name"- "file name"- "file name" "
- **Terms** define pricing and other definitions indicated by "term"

#### 4.5.3.2 Agrotourism Post Format

##### Example:

key1\_"key"/key2\_"key"/fruitful\_app/geoLat\_17.18113,  
geoLong\_-48.11553/Usrn\_Fruitful1/email\_fruitful1@gmail.com/phn\_+15028851367/

- **Title** indicated by "t"
- **Description** indicated by "d"
- **Type** indicated by "t"
  - Market Garden indicated by "m"
  - Event indicated by "e"

- Entertainment indicated by “e”
  - Education
  - Volunteering
  - Community
  - Tour
- Cost
- Location
- Photo/Video files (up to 5)
- Date Time

#### 4.5.3.3 Direct Market Post Format

- Title
- Description
- Type
- Variety
- Use Category
  - food
  - pharmaceutical
  - fiber
  - chemical
  - mineral
  - ornamental
- Date Harvested
- Expected Spoil Date
- Starting Inventory
- Sold by amount
- Sold by Price
- Documentation
- Pickup/Delivery (choose all available)
- User Address if pickup available
- User logistics cost

#### 4.5.3.4 Plan Post Format

##### 4.5.3.4.1 Consumer Plan

- Title
- Description
- Type
- Variety
- Use Category
  - food
  - pharmaceutical
  - fiber
  - chemical

- mineral
  - ornamental
- Desired Planting Date
- Desired Harvest Date
- Needed by Date
- Required Amount
- Price per Amount
- PING Rate
  - Daily
  - Weekly
  - Monthly
- Allow Contract Shares?
  - If yes select Fixed or Variable shares
- Optional Information
  - Hydration Plan
  - Nutrition Plan
  - Health Plan
- Contract Price = price per volume \* demanded volume

#### 4.5.3.4.2 Producer Plan

- Title
- Description
- Type
- Variety
- Use Category
  - food
  - pharmaceutical
  - fiber
  - chemical
  - mineral
  - Ornamental
- Planting Date
- Expected Harvest Date
- Hydration Plan
- Nutrition Plan
- Health Plan
- Expected Yield
- Sold by amount
- Sold by price
- PING rate
  - Daily
  - Weekly
  - Monthly
- Contract Shares?

- If yes select fixed or variable shares

#### 4.5.3.5 Product Post Format

- Title
- Description
- Category
  - Value-Added Good
  - Seeds, Live Plants or Young
  - Node Management Tools
  - Node Infrastructure & Environmental Control
  - Soil Input
- Price Per Item
- Starting Inventory/Made on order
- Photo file (up to 10)
- Terms

#### 4.5.3.6 Open PING Post Format (System Generated)

- Title
- Description
- Type
- Variety
- Use Category
  - food
  - pharmaceutical
  - fiber
  - chemical
  - mineral
  - Ornamental
- Planting Date
- Expected Harvest Date
- Hydration Plan
- Nutrition Plan
- Health Plan
- Contract Description
- Expected Yield
- Sold by amount
- Sold by price
- PING rate
  - Daily
  - Weekly
  - Monthly
- Contract Shares?
- If yes select fixed or variable shares

- Originator: Username of person who planned this product

#### 4.5.4 Transaction Orders

- Records in-UI purchases of network products and services, updates the network

##### Example:

*key1\_"key"/key2\_"key"/fruitful\_app/geoLat\_17.18113,  
geoLong\_-48.11553/Usrn\_Fruitful1/email\_fruitful1@gmail.com/phn\_+15028851367/trns\_"postID"over*

- This example requests a transaction on a post by listing its unique ID

##### 4.5.4.1 Transaction Control Module

Controls the UI's transaction permissions to prevent double transactions on products and services with limited availability.

- Checks if post ID data matches records. If not, the UI is given a no ID error.

###### 4.5.4.1.1 Transaction Control

- If the reference is correct, and no transaction precedes it, the UI sending the request is given permission to execute the transaction, and the post ID removal order sent before the next transaction is processed

###### 4.5.4.1.2 Transaction Routing

###### 4.5.4.1.2.1 Delayed Settlement

- All delayed settlements place a hold on the consumer's account or hold funds with the as an intermediary between consumer and producer
- If the transaction was a plan purchase, a PING ID is assigned, transmitted to the UI and Open PING Database
- PING frequency, planting date and harvest date data are transmitted to the Network Calendar Interface
- If the transaction was a PING purchase, a new PING ID is assigned and consumer data updated to the purchasing user

###### 4.5.4.1.2.2 Immediate Settlement

Transactions on all other post types are considered final transactions

###### 4.5.4.1.3 Final Transactions

- All transactions other than Plan and PING purchases are final transactions
- Plan and PING purchases are finalized on their final PING dates, established in the original plan data.
- Funding settlements may only be authorized by the UI once LBTAS ratings are received by the Agrinet



- Final transactions initiate a pull order to the Open-Dialog Module to create a Mycelium record

#### 4.5.5 Messages

- User-to-user messages opened in respect to potential, pending and completed transactions, PING Updates and LBTAS ratings

##### EXAMPLE:

*key1\_"key"/key2\_"key"/fruitful\_app/geoLat\_17.18113,  
geoLong\_-48.11553/Usrn\_Fruitful1/email\_fruitful1@gmail.com/phn\_+15028851367/msg\_"message string"/subj\_"postID"*

- This example transmits a message with a post ID as the subject

##### 4.5.5.1 Formats

###### 4.5.5.1.1 Standard Messages

*key1\_"key"/key2\_"key"/fruitful\_app/geoLat\_17.18113,  
geoLong\_-48.11553/Usrn\_Fruitful1/email\_fruitful1@gmail.com/phn\_+15028851367/msg\_"message string"/subj\_"transactionID"/over*

- May only be sent in reference to a specific subject, for example a post or transaction, identified by its ID.

###### 4.5.5.1.2 LBTAS Rating Messages

##### EXAMPLE:

*key1\_"key"/key2\_"key"/fruitful\_app/geoLat\_17.18113,  
geoLong\_-48.11553/Usrn\_Fruitful1/email\_fruitful1@gmail.com/phn\_+15028851367/msg\_"message string"/subj\_"transactionID"/lbtas\_(rating value)/over*

- LBTAS ratings are required as part of a response to every message, transaction, and PING report.
- Consumers may add an optional rating up to three months post transaction, producers will have up to three months to reply to this rating with a Reviewer Rating

###### 4.5.5.1.2.1 LBTAS Module

- Averages user ratings and transmits to UIs to help communities spot and correct bad user behavior.
  - Consumer Rating

- Producer Rating
- Reviewer Rating
- LBTAS ratings are required from the producer and consumer in any communications across the Agrinet.
- Achieving a -1 rating in the Agrinet's average will permanently ban the user from operating with associated data (name, address, phone, email) on any UI platform

#### 4.5.5.1.2.2 LBTAS (*the Leveson-Based Trade Assessment Scale*)

##### [Readme](#)

A trade assessment scale based on Nancy Leveson's Software Assessment Scale developed for evaluating software used in airborne vehicles.

Contemporary trade assessments based on 5-star systems do not provide data that motivates producer improvement. Developed in the United States, apparently by Forbes Travel Guide, formerly Mobil Travel Guide, in 1958. This system was used to advertise hotel quality along popular travel routes as part of a larger campaign to encourage cross-country driving trips using the new US interstate highway system and was never meant to be a two-way communication system. As a result, ratings hold little to no value in e-commerce where they are most commonly applied. In many cases, PR managers place minimal effort toward rationalizing with customers and represent a barrier to companies changing internal policies to improve customer experience.

The Leveson System was developed in the high-stakes arena of aircraft software development where if a system fails, someone dies or at the very least, tens of thousands of dollars in research and development investments are wasted. Leveson still uses a similar 6-point system with ratings from positive 4 to negative 1. Leveson also further defines each category allowing users to compress more meaning behind the rating. This reduces the need for comment sections for more data.

SCALE DESCRIPTIONS (Adapted) +4 Delight Interaction anticipates the evolution of user practices and concerns post-transaction

+3 No Negative Consequences Interaction designed to prevent loss, exceed basic quality

+2 Basic Satisfaction Interaction meets socially acceptable standards exceeding articulated user demands

+1 Basic Promise Interaction meets all articulated user demands, no more

0 Cynical Satisfaction Interaction fulfills a basic promise requiring little to no discipline toward user satisfaction

-1 No Trust User was harmed, exploited, or received a product or service with evidence of no discipline or malicious intent

Though not a two-way communication system on its own, the assessment function may be levied against both consumer and producer in a digital collective intelligence network; identifying bad actors on both sides of transactions for future users. For example, a network may maintain average ratings for producers to identify unskilled providers, and a consumer rating to identify exploitative or difficult customers.

This program was produced by the Network Theory Applied Research Institute's Forge Laboratory by Jodson B. Graves using ChatGPT3 on September 4, 2024. Learn more and support Forge Laboratory at <https://ntari.org/forge>

Aprovechar

---

*Code:*

"""

### **Leveson Software Assessment Scale**

=====

**This module provides a Leveson Software Assessment Scale for rating software exchanges.**

**It is designed in compliance with the Digital Public Goods Standard.**

**This software is open-source and is licensed under the MIT License.**

**Author: Your Name**

**License: MIT License**

"""

```
class LevesonRatingSystem:
```

```
    def __init__(self):
```

```
        self.exchanges = {}
```

```
    def add_exchange(self, name):
```

```
        """Add a new exchange to the system."""
```

```
        if name not in self.exchanges:
```

```
            self.exchanges[name] = {
```

```
                'reliability': [],
```

```
                'usability': [],
```

```
                'performance': [],
```

```
                'support': []
```

```
            }
```

```

else:
    raise ValueError(f"Exchange '{name}' already exists.")

def get_rating(self, criterion):
    """Get a rating from the user for a specific criterion."""
    rating_descriptions = {
        -1: "No Trust - User was harmed, exploited, or received a product or service with no discipline or malicious intent.",
        0: "Cynical Satisfaction - Interaction fulfills a basic promise requiring little to no discipline toward user satisfaction.",
        1: "Basic Promise - Interaction meets all articulated user demands, no more.",
        2: "Basic Satisfaction - Interaction meets socially acceptable standards exceeding articulated user demands.",
        3: "No Negative Consequences - Interaction designed to prevent loss, exceed basic quality.",
        4: "Delight - Interaction anticipates the evolution of user practices and concerns post-transaction."
    }

    print(f"Rate {criterion.capitalize()}:")
    for rating, description in rating_descriptions.items():
        print(f" {rating}: {description}")

    while True:
        try:
            rating = int(input(f"Enter your rating for {criterion.capitalize()} (-1 to 4): "))
            if -1 <= rating <= 4:
                return rating
            else:
                print("Please enter a rating between -1 and 4.")
        except ValueError:
            print("Invalid input. Please enter a number between -1 and 4.")

def rate_exchange(self, name):
    """Rate an exchange based on Leveson Software Assessment Scale."""
    if name not in self.exchanges:
        raise ValueError(f"Exchange '{name}' does not exist.")

    print(f"Rating {name} based on Leveson Software Assessment Scale")
    for criterion in self.exchanges[name]:
        rating = self.get_rating(criterion)
        self.exchanges[name][criterion].append(rating)

def view_ratings(self, name):

```

```

        """View the average ratings for a specific exchange."""
        if name not in self.exchanges:
            raise ValueError(f"Exchange '{name}' does not exist.")

        ratings_summary = {}
        for criterion, ratings in self.exchanges[name].items():
            if ratings:
                avg_rating = sum(ratings) / len(ratings)
                ratings_summary[criterion] = round(avg_rating, 2)
            else:
                ratings_summary[criterion] = None

        return ratings_summary

    def get_all_exchanges(self):
        """Return a list of all exchanges."""
        return list(self.exchanges.keys())

# Example usage in a larger program:
if __name__ == "__main__":
    rating_system = LevesonRatingSystem()

    # Adding exchanges
    rating_system.add_exchange("ExampleExchange1")
    rating_system.add_exchange("ExampleExchange2")

    # Rating an exchange
    rating_system.rate_exchange("ExampleExchange1")

    # Viewing ratings
    ratings = rating_system.view_ratings("ExampleExchange1")
    print("Ratings summary:", ratings)

```

#### 4.5.5.1.3 PING Updates

##### EXAMPLE:

```

key1_"key"/key2_"key"/fruitful_app/geoLat_17.18113,
geoLong_-48.11553/Usrn_Fruitful1/email_fruitful1@gmail.com/phn_+15028851367/ping_file1/fi
le2/file3/PINGID/"date and UTC"/over"

```

- PING reports may have up to five files
- Updates are given unique IDs and added to Open Dialog Data

## 5. Settings

PING Listings

on/off toggle plan purchases visibility on PING market

## 6. Backend

### 5.1 Map

- Provides a global map of all production nodes on a Google Earth API

### 5.2 Calendar

- Provides a schedule of all PING messages

### 5.3 Monitoring

- Detects and eliminates illegal content using machine learning based on backend user training

### 5.4 Open Dialog

- Allows backend users to view global open dialog