

# Home broadband autonomic installation and maintenance

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## Background and brief introduction

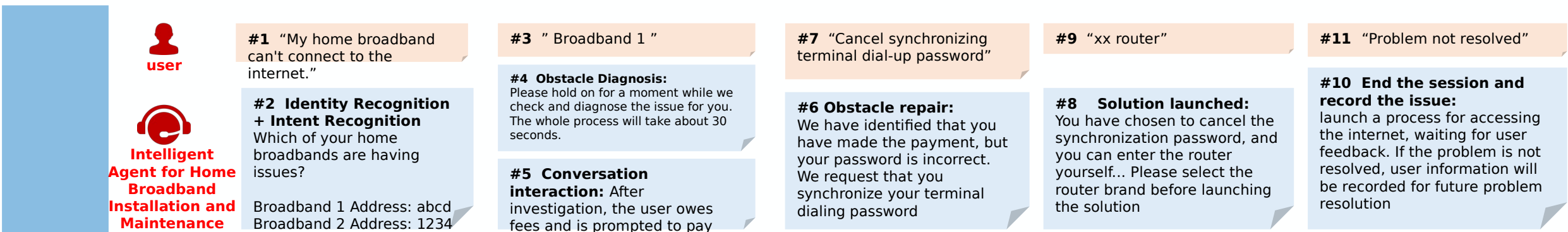
- The levels of installation and maintenance capabilities vary widely, with average issue resolution time being approximately 20 minutes for senior technicians with more than 3 years of experience, and about 40 minutes for new technicians within their first year.
- Accessing relevant knowledge for broadband installation and maintenance is not convenient, nor is querying training-related information. There is a lack of systematic documentation of frontline installation and maintenance experience.
- The transmission of process information is not timely, and some real-time information queries (such as user packages, line and equipment transfer resources, and major network faults/cutover information that affect individual user experiences) are not easily accessible.

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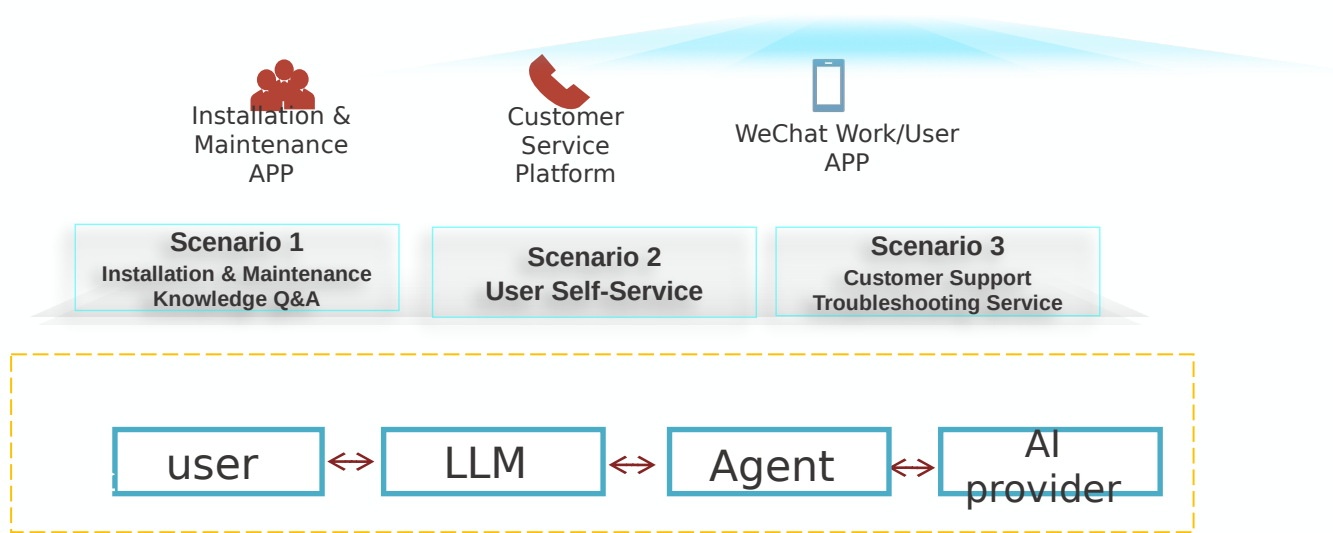
## a) Scenarios of broadband installation and maintenance that only require manual assistance

Problem	How to solve
operator makes mistakes	Strengthen operator training to reduce the frequency of similar errors
user can only call from the cell-phone because his Internet is down	Arrange for technical personnel to come and inspect and repair the network over the phone
cell-phone has no direct access to the in-home internet equipment to be diagnosed.	Arrange technical personnel to conduct on-site inspections of network equipment and mobile phone settings
network equipment misses important API to retrieve information	Manually guide users to update firmware or software
Diagnostics can only be started remotely from a cloud-based application by the operator, not the user.	communication with users to understand the specific problems they encounter

## b) Realize intelligent diagnosis and one-click repair of new business faults through the combination of large network models, agents, and product diagnostic and repair capabilities.



# Background and brief introduction



## Five Key Technologies for Innovation



**Intention Understanding and Generalization**



**High-Precision Task Planning**



**Result Reflection/Re-planning**



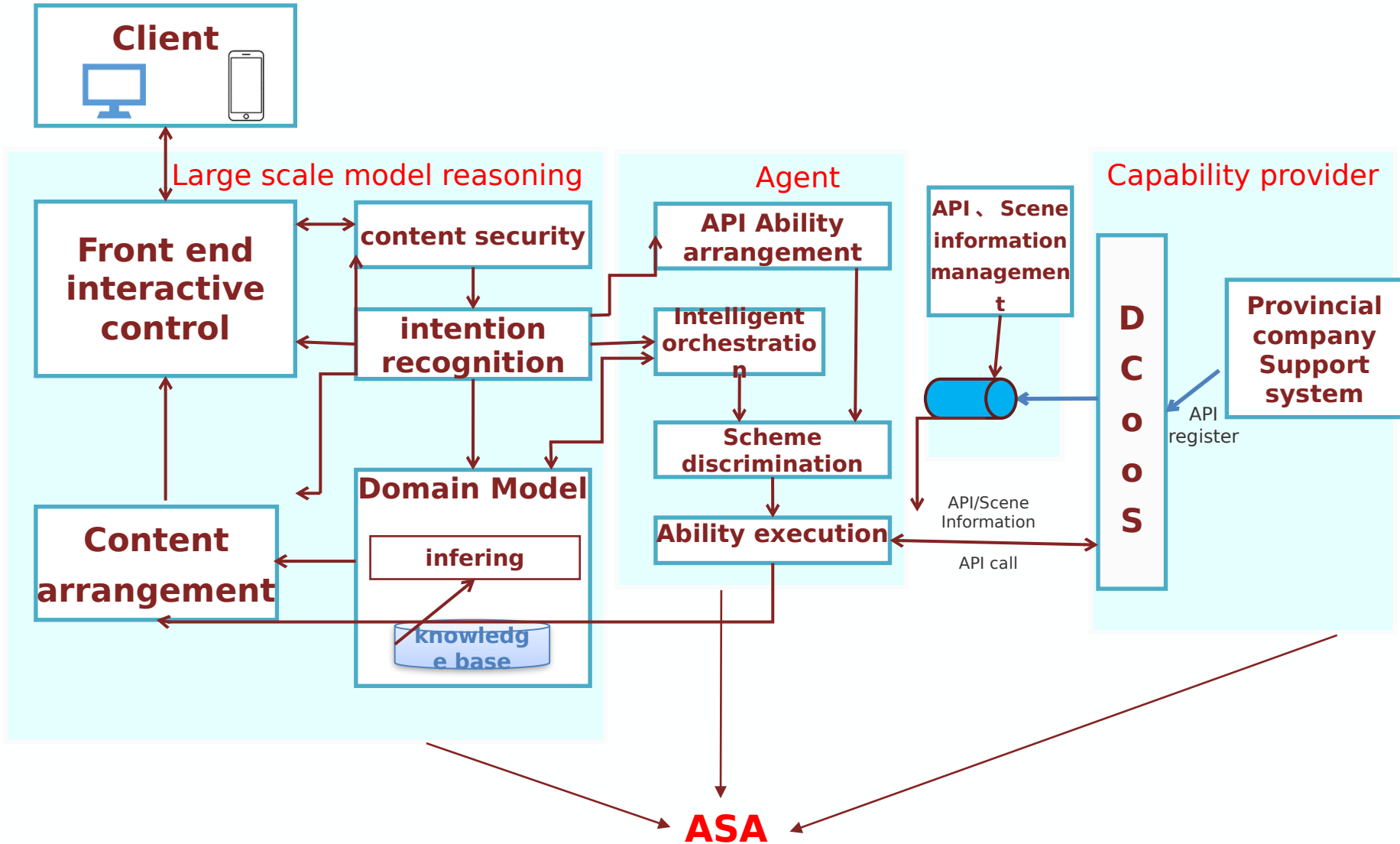
**Short/Long-term Memory, Supporting Accurate Intention Recognition and Task Planning.**



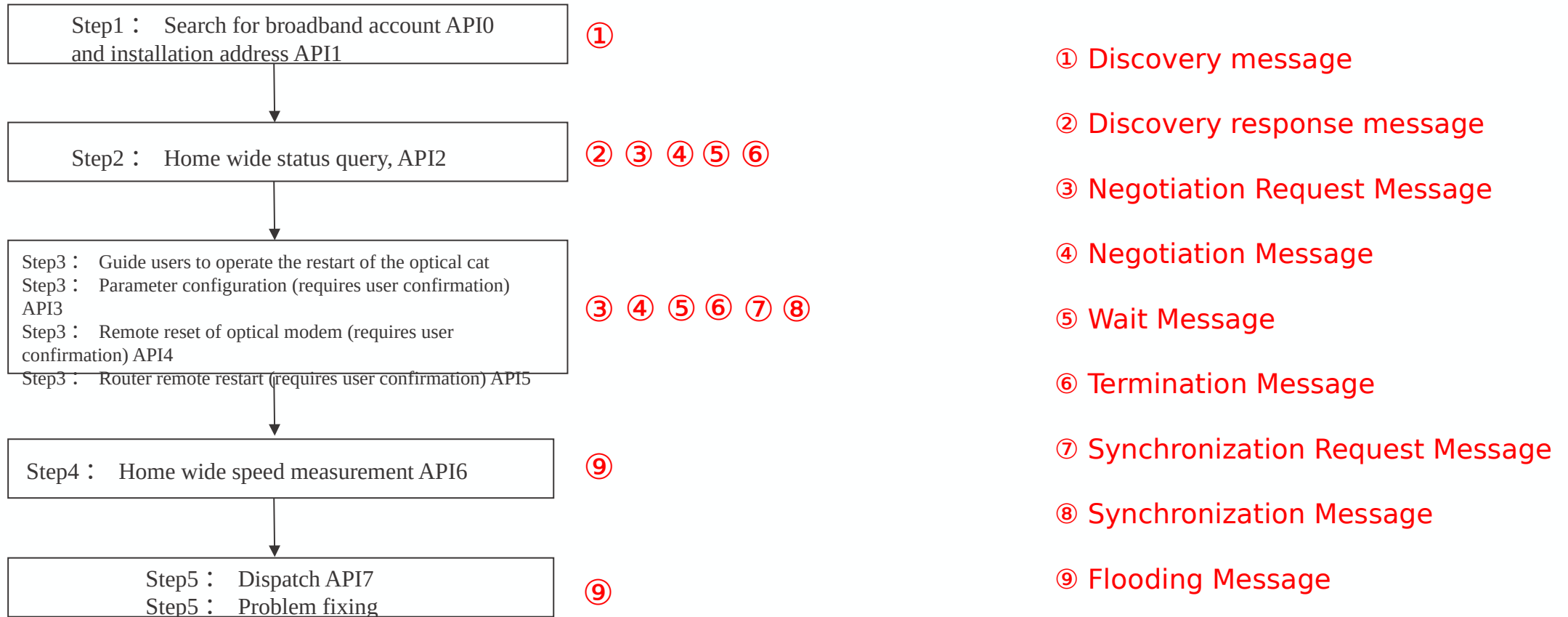
**Flexible Management of Tools**

Using GRASP protocol for collaborative innovation of large-scale models and wide range scenarios, creating a self-service intelligent agent solution to improve installation and maintenance efficiency

# Process Example



# The relationship with the GRASP protocol



The GRASP protocol contains 9 types of information , matching of message types between the self-service process of home wide installation and GRASE protocol

# Advantages over the Yang model

The limitations of the Yang model in the face of complex and ever-changing home broadband installation and maintenance scenarios are as follows:

- **Limited Flexibility:** When confronted with complex and diverse home broadband installation and maintenance scenarios, which typically involve multiple devices, protocols, and business requirements that may exceed the predefined scope of the Yang model, its flexibility may be restricted. Therefore, when there is a need to quickly adapt to new demands or resolve sudden issues, the Yang model may appear insufficiently flexible.
- **Limited Adaptability:** In addition to limited flexibility, the adaptability of the Yang model may also be constrained. Adaptability refers to a model's ability to adjust and optimize in the face of different environments and conditions. In home broadband installation and maintenance scenarios, due to variations in device types, network environments, business requirements, and other factors, frequent adjustments to configuration parameters and data structures may be necessary. However, the fixed structure of the Yang model may make such adjustments difficult or impossible.

# Optimizations and Innovations to the GRASP Protocol

- Optimize Device Discovery Mechanism

Existing Functionality: The GRASP protocol already provides a `discover()` function for device discovery, supporting multicast and caching mechanisms.

Optimization Points: By adjusting the timeout and `minimum_TTL` parameters, the discovery process can be accelerated and network load reduced. When the network condition is good and devices respond quickly, the timeout can be appropriately shortened to reduce waiting time.

Conversely, when the network condition is poor or devices respond slowly, the timeout should be appropriately extended to ensure that devices have sufficient time to respond to discovery requests.

- Optimize Device Negotiation Mechanism

Existing Functionality: The GRASP protocol supports `request_negotiate()` and `negotiate_step()` functions for negotiation between devices.

Optimization Points: Support high-concurrency negotiation through multithreading or event loop mechanisms, and dynamically adjust the negotiation process using `negotiate_wait()`.

In broadband installation and maintenance scenarios, due to the large number of devices that may simultaneously initiate negotiation requests, the traditional single-threaded negotiation mechanism may lead to response delays and performance bottlenecks.

By introducing a multithreading mechanism, multiple negotiation requests can be processed simultaneously, improving the system's concurrent processing capability.

The multithreading mechanism also enables more granular resource management and load balancing, ensuring the smooth progress of the negotiation process.

## Event Loop Mechanism

The event loop mechanism is a non-blocking asynchronous processing method, suitable for scenarios with high concurrency and real-time requirements.

In the GRASP protocol, the event loop mechanism can be utilized to monitor and process negotiation requests, avoiding performance issues caused by traditional blocking calls.

Through the event loop mechanism, asynchronous processing and rapid response to negotiation requests can be achieved, improving the system's overall performance and user experience.

# THANK YOU