New Service Creation via Brokering and Mediation

Research Direction and Approach

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Outline

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- Challenges
- Examples of Challenges
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Motivation

- All service/network providers are searching for new services as new sources of revenue
- Not necessarily brand new services (slow process) but creative integration of successful existing services (rapid creation)
- Recent notable examples (Hot in Telecom now …)
  - Fixed Mobile Convergence (FMC) Services
    - FastForward from BellSouth and SBC
    - OnePhone from KT, BT, and Verizon
  - IPTV Triple Play Services
    - Web Browsing, IM, Caller ID, Call Management, & Video on TV
- No framework exists in addressing service creation in this new direction

Challenges (1)

- What's new from the past
  - Applications under integration are all independently developed and successfully deployed. Thus,
  - Only externally observable (I/O) behaviors can be made available from applications; internal details of the applications should be assumed unavailable for the purpose of integration.
  - No or little change of the applications can be done for the purpose of integration.

Challenges (2)

- Practical questions to be addressed:
  - Can these applications be integrated? If they are, how many possibilities of integration exist?
  - If there are many integration possibilities, how to enforce a desired service behavior after they are integrated?
- Knowledge in FI detection and management can facilitate this new service creation

Examples

- **Can applications be integrated?** Not always
  - Voice services Call Forwarding and Caller ID
  - Data services E-mail Forwarding and Vacation Auto Reply
- **If applications can be integrated, how many possibilities of integration exist?**

  Given three originating voice services: Screening, Number Translation, Call Logging, how many new services can we derive from them?

  (1) 4 (2) 6 (3) 8 (4) none of above

Examples (Cont.)

- **If there are many integration possibilities, how to enforce a desired service behavior after they are integrated?**
  - Some possibilities listed (informally) here
    - Screen on the dialed number and log every call attempt
    - Screen on the dialed number and log only the successful call,
    - Screen on the translated number and log every call attempt, or
    - Screen on the translated number and log only the successful call.

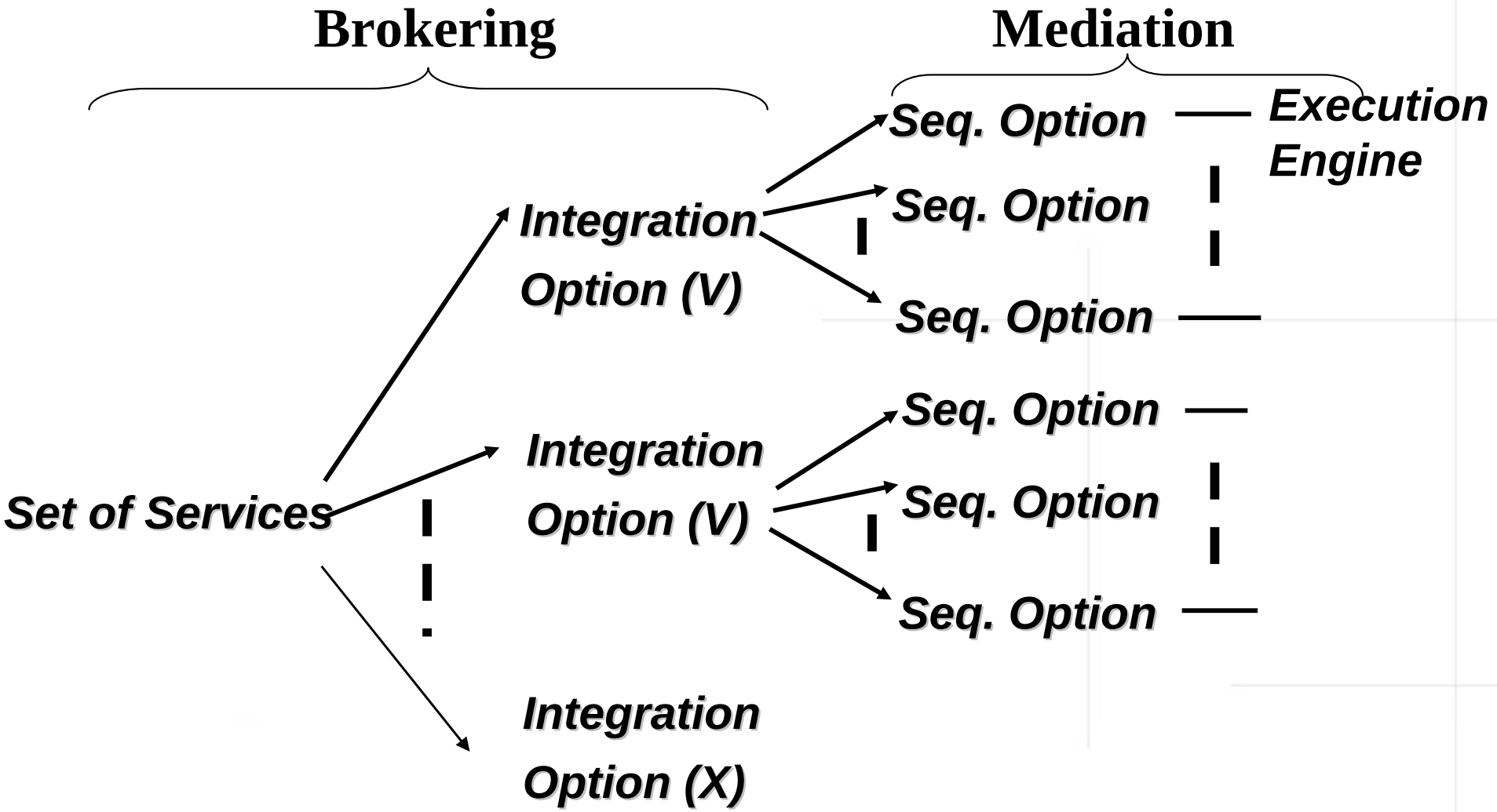
Our Approach – Define a Framework

- Define a framework to address these questions
  - Begin with simpler problems
    - Applications do not interleave with one another
  - The problems become how to sequence the execution of applications. There can be many ways of sequencing applications including parallel execution of certain applications. Each produces a different service behavior thus the creation of a new service.

Our Approach – Brokering and Mediation

- Define two mechanisms
  - *Service Brokering* - to figure out how many *possibilities of integration* (if ever exist) are possible with multiple given applications
  - *Service Mediation* - to enforce *a desired behavior of service integration* when multiple applications are integrated together

Our Approach – Pictorial Illustration



Our Approach – Technical Details (1)

- Service Brokering
  - Define pairwise *behavioral relations* among services
  - Associate *precedence relations* with behavior relations
- Applying to voice features

  Behavioral Relations
  - A is independent of B (denoted by A | B)
  - B uses information generated by A (denoted by A -> B)
  - A disables B by disconnecting the call and prevent B from affecting call processing (denoted by A ! B)
  - A is incompatible with B (denoted by A # B)

Our Approach – Technical Details (2)

- Applying to voice features (Cont.)

  Precedence Relations

  – A | B implies A, B can be executed simultaneously, denoted (A, B)

  – A -> B implies A must be executed before B, denoted A < B

  – A ! B implies A < B or (A, B) with synchronization between responses

  – A # B implies these two features are mutually exclusive

Examples

- Pairwise behavior relations among Screening (denoted by S), Number Translation (denoted by NT), and Logging (denoted by L)
  - S and NT: S ! NT or NT -> S
  - S and L: S | L or S ! L
  - NT and L: NT -> L or NT | L
- Now we can express
  - Screen on the dialed number and log every call attempt
    - S ! NT, S | L, NT | L (or NT->L)
  - Screen on the dialed number and log only the successful call,
    - S ! NT, S ! L, NT | L (or NT->L)
  - Screen on the translated number and log every call attempt, or
    - NT -> S, S | L, NT | L (or NT->L)
  - Screen on the translated number and log only the successful call.
    - NT -> S, S ! L, NT | L (or NT->L)

Examples (Cont.)

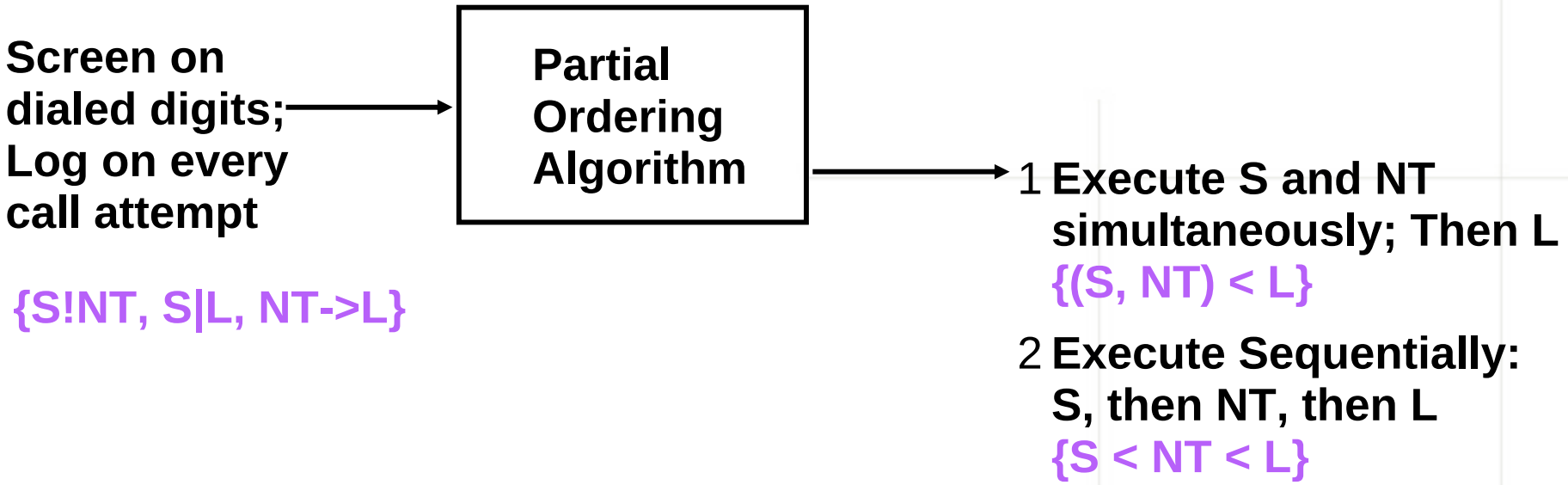
- For Integration S ! NT, S | L, NT -> L, we can derive the following precedence relations among S, NT, and L :
  - Between S and NT (S!NT): either S < NT or (S, NT)
  - Between S and L (S | L): (S, L)
  - Between NT and L (NT->L): NT < L

Our Approach – Technical Details (3)

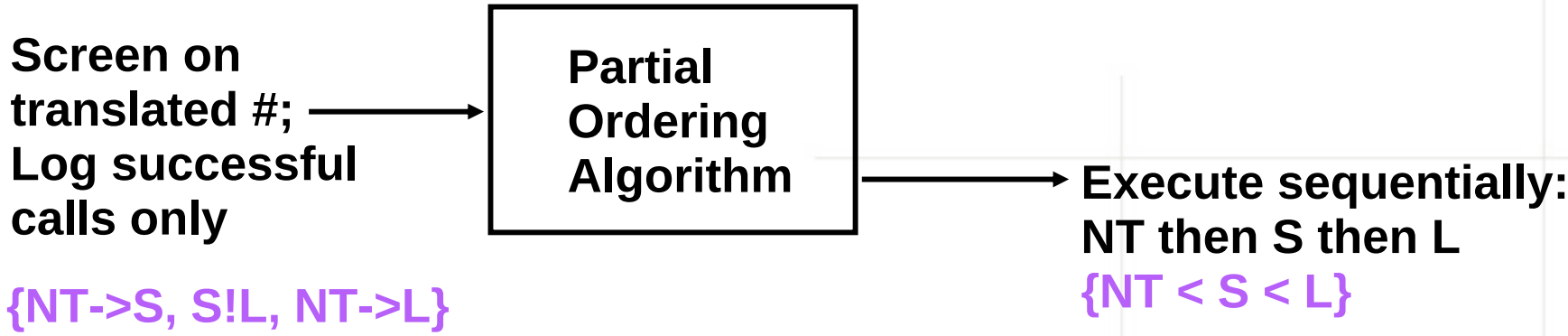
Mechanism for Service Brokering -

- Define *Behavior Relations* and its implied *Precedence Relations* for the applications under integration.
- Enumerate all the integration options among these applications.
- Check if each of integration options is *consistent* (i.e. constitutes a partial ordering) or *inconsistent* based on their precedence relations.
- If no consistent integration options can be found for the applications, the applications can not work together due to feature interactions. Otherwise, the consistent integration option thus discovered are all the possible ways of service integration among given applications.

Examples



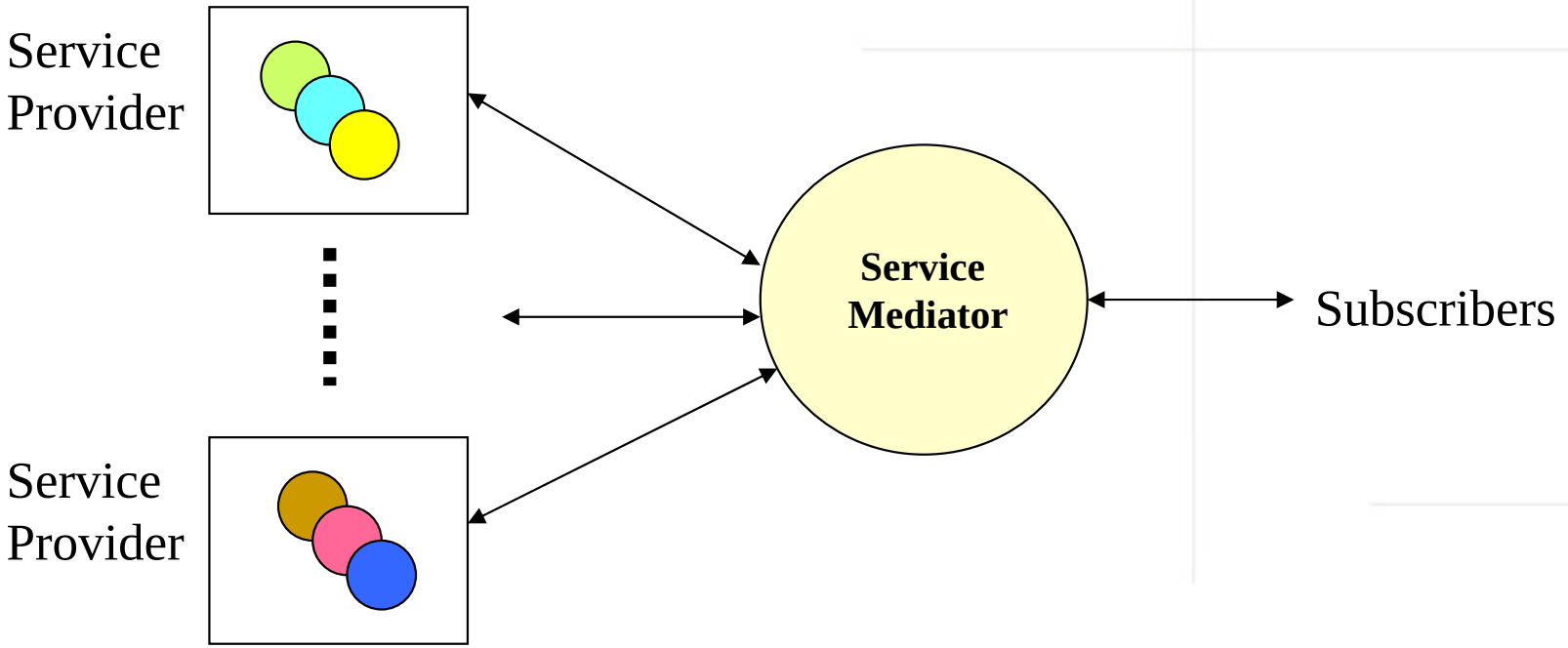
Examples (Cont.)



Our Approach – Technical Details (4)

Mechanism for Service Mediation -

- Service Mediation is the sequencing logic of multiple applications under integration. Normally, this logic will be implemented in a network component called *Service Mediator*



Summary

- Work best in a controller environment
- Service brokering will be realized in an offline provisioning environment
- Service mediation will be realized in a real time execution environment
- Further work in applying to data and video services – goal is to be able to deal with triple play (voice, data, and video) services
- Further work in applying to interleaving applications
- Behavior Relations tailored for specific domain
- Software platform required to support the approach
  - *Service broker* being discussed as part of emerging IMS/NGN architecture in telecom. Several vendors claim to have solutions.