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shaping tomorrow with you

PlugFest diagrams and Architecture document

3 July, 2018

Ryuichi Matsukura
Fujitsu Laboratories Limited

Achievements of the previous PlugFest

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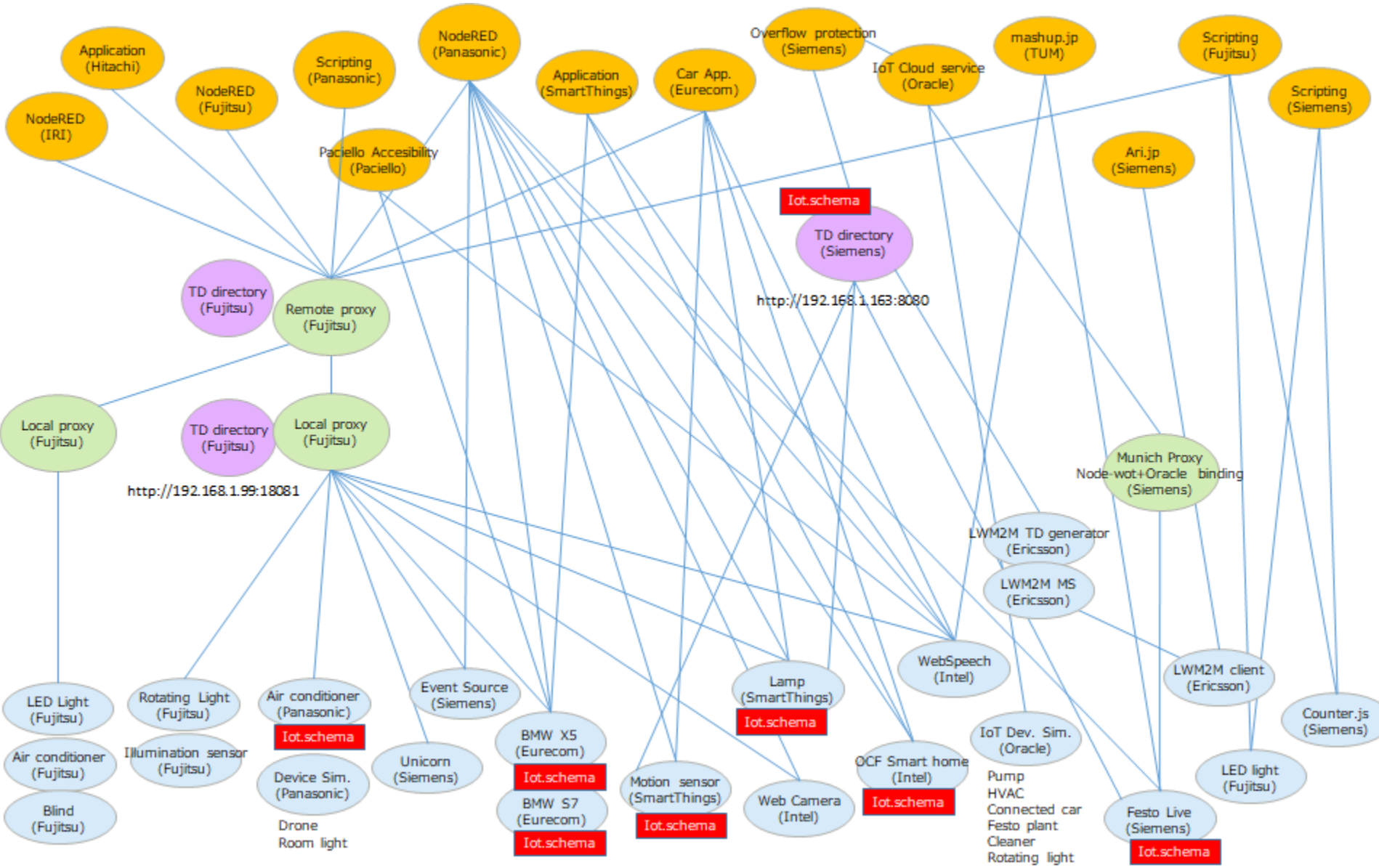

Checking points for Bundang PlugFest

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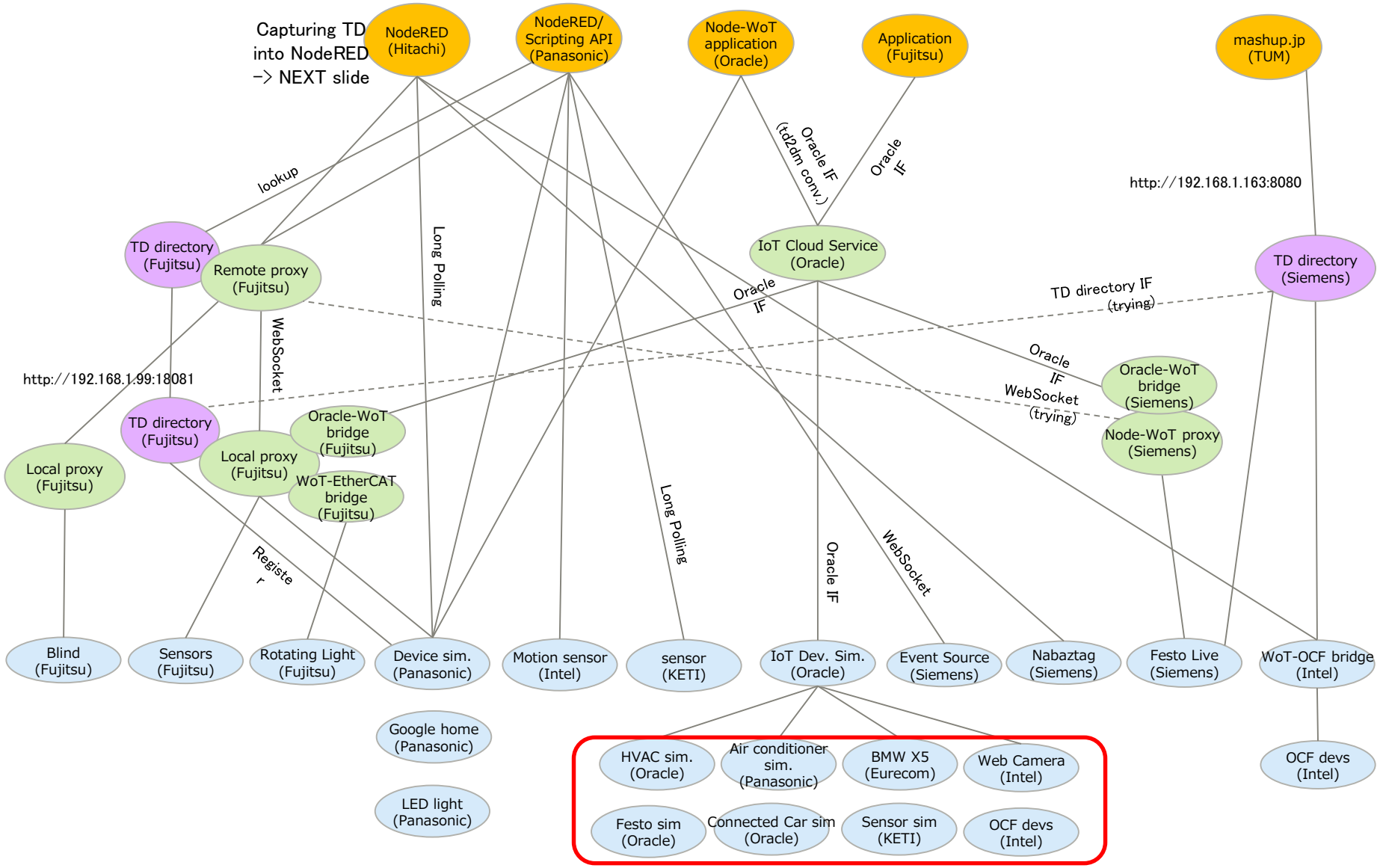
- **Multiple proxy interaction**
- **Application servients/Device servients**
- **Node-wot as a servient**
- **Scripting API implementation**
- **Thing Directory operation (multiple-directory integration)**
- **Device simulators**
- **Semantic integration (iotschema.org)**
- **Security (API keys, etc.)**
- **Accessibility**
- **Event handling**

Achievements of this PlugFest



These simulated devices are generated by TDs for this Plugfest on Github.

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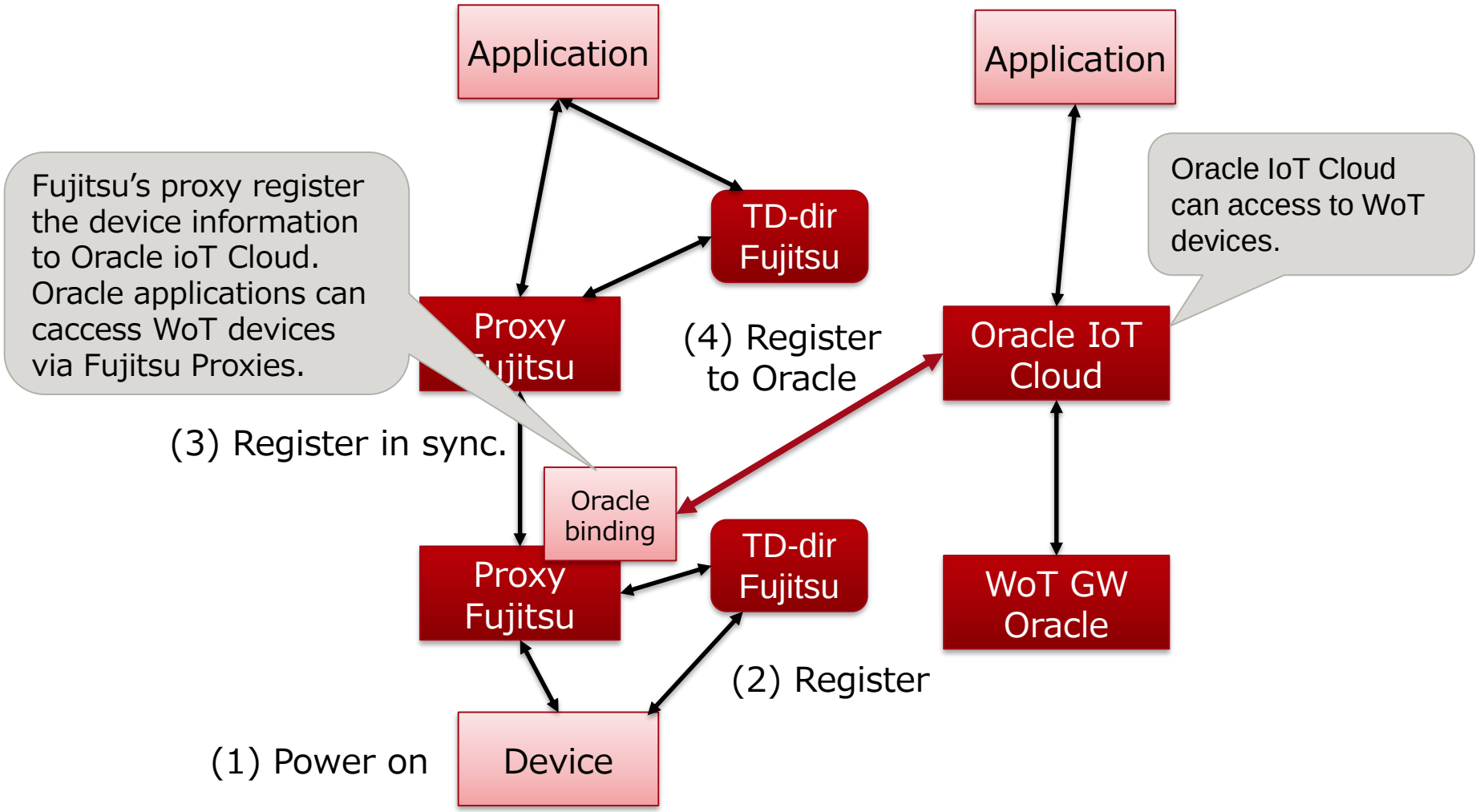
Multiple proxy and directory integration

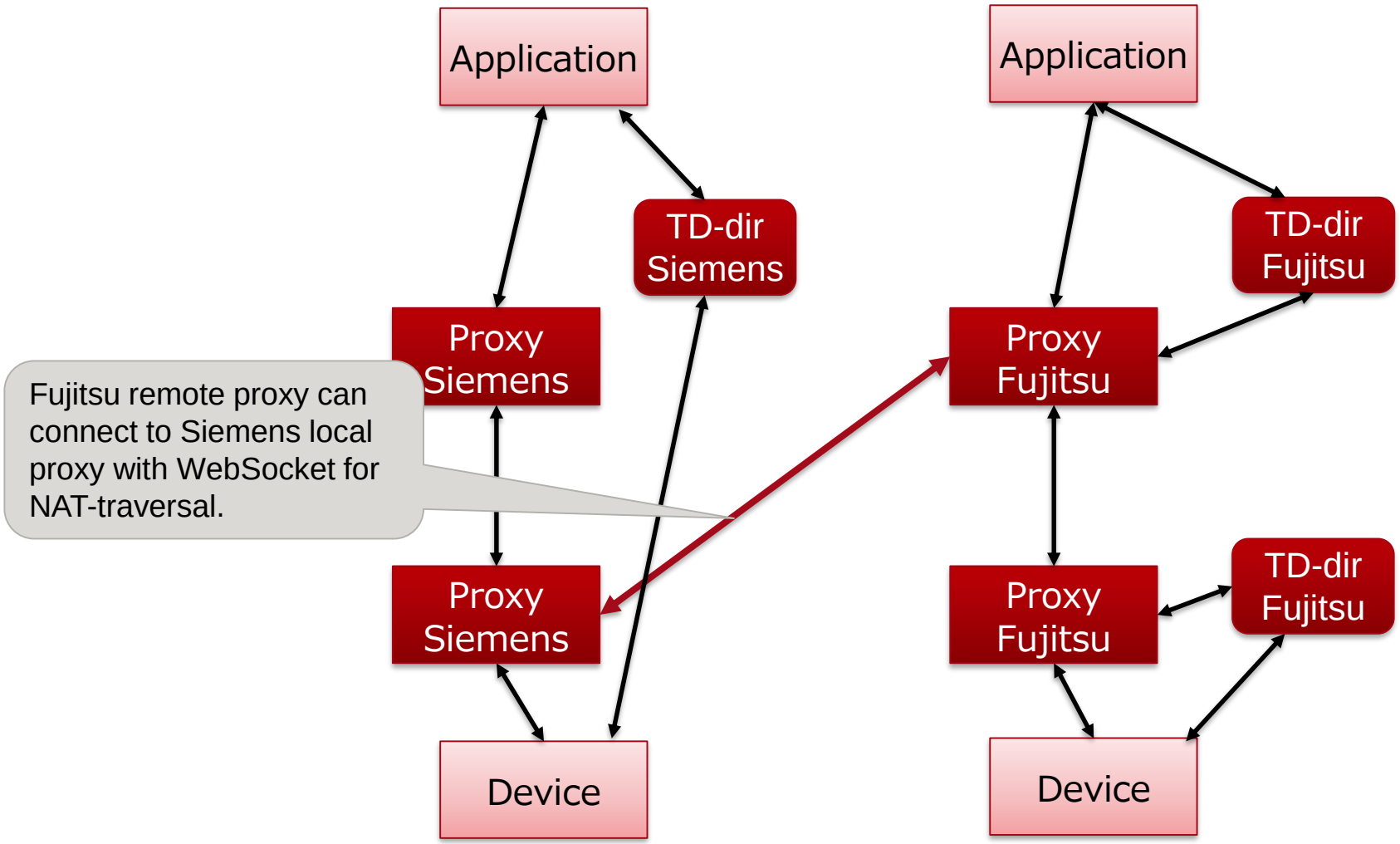
Connection with Oracle IoT Cloud

- Fujitsu proxy can connect with Oracle binding to transform Oracle IoT Cloud propriety interface



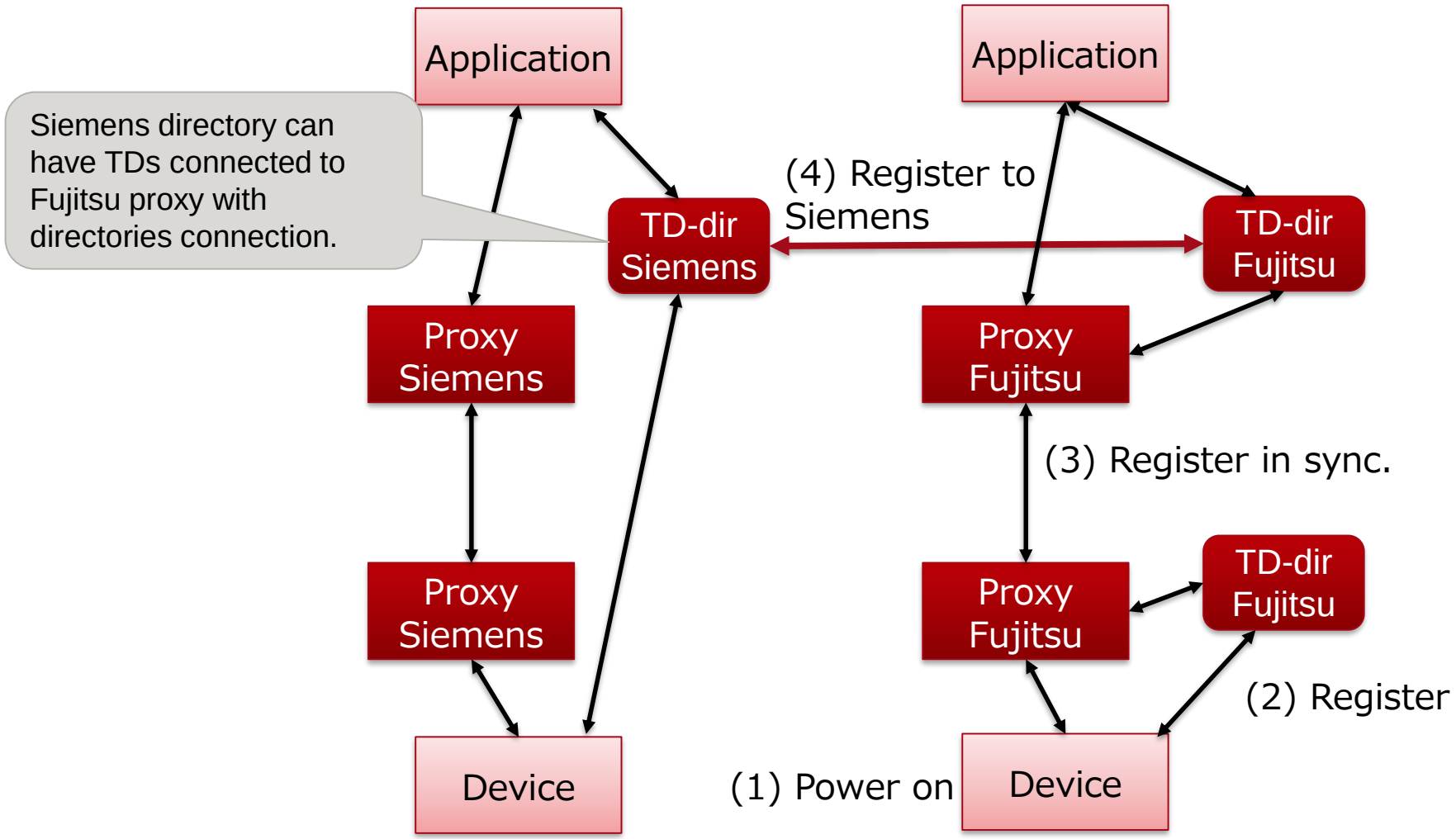
Connection with Siemens proxy

- Fujitsu Remote proxy servient can connect to Siemens local proxy with WebSocket



Connection with Siemens TD directory

- Fujitsu TD directory synchronize TDs of devices to be connected to Fujitsu Proxy to Siemens directory.

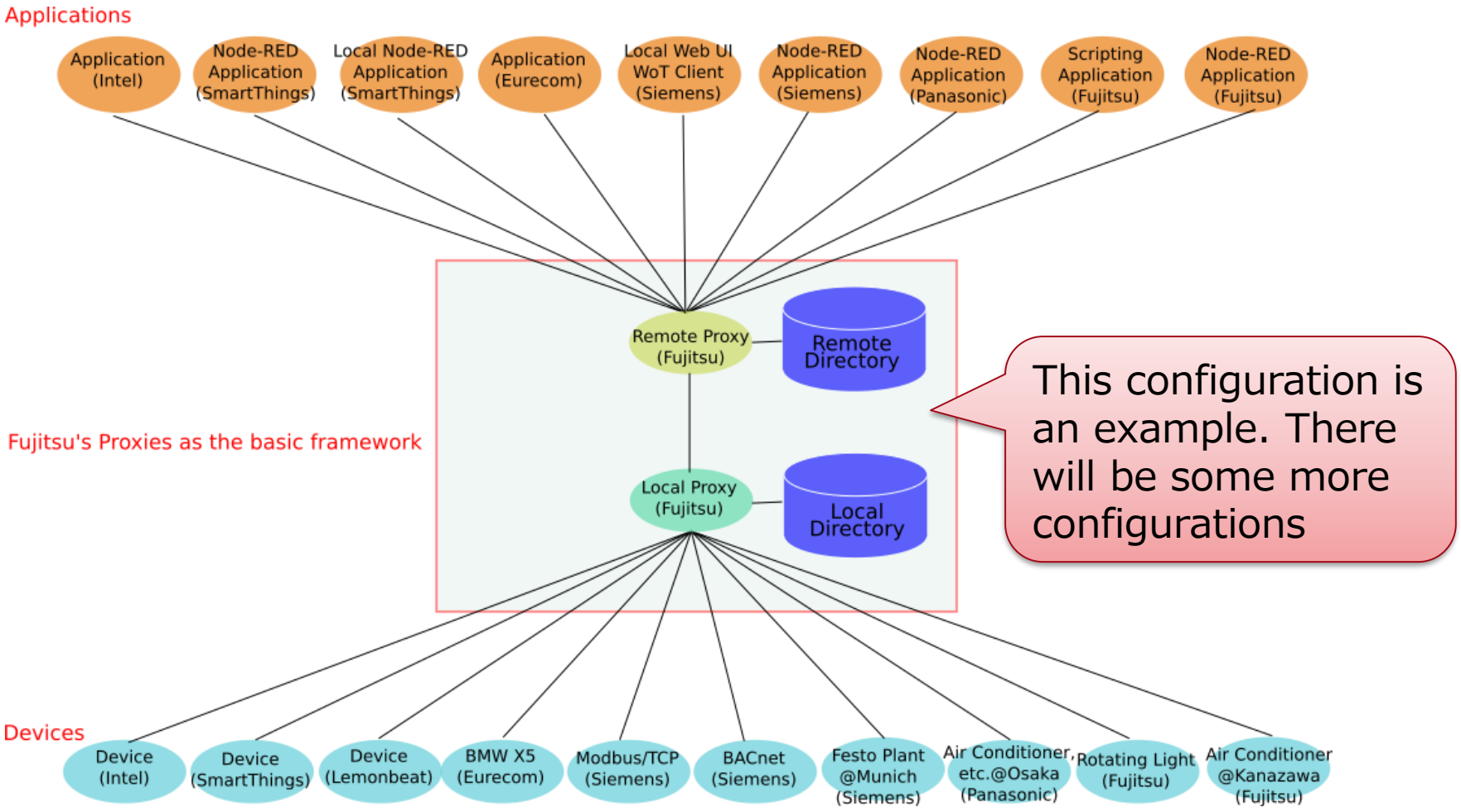


Integration by proxy servients

- WoT proxy servient can coordinate Non-WoT entities
  - Oracle IoT Cloud Service
  - ECHONET Lite, EtherCAT
  - Various kind of applications and devices will be coordinated.

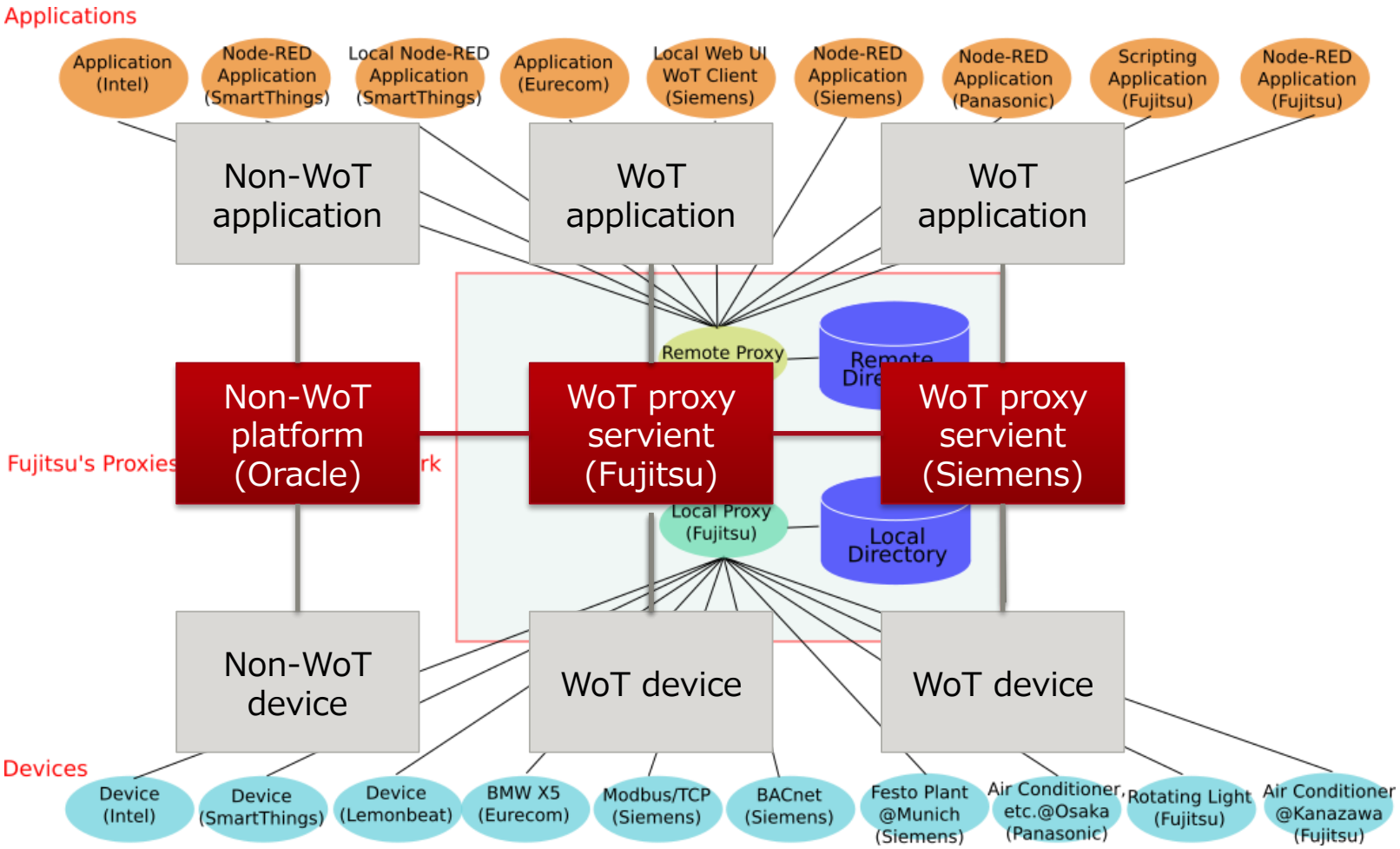
Narrow Waist model

- Proxies coordinate the connections between applications and devices.



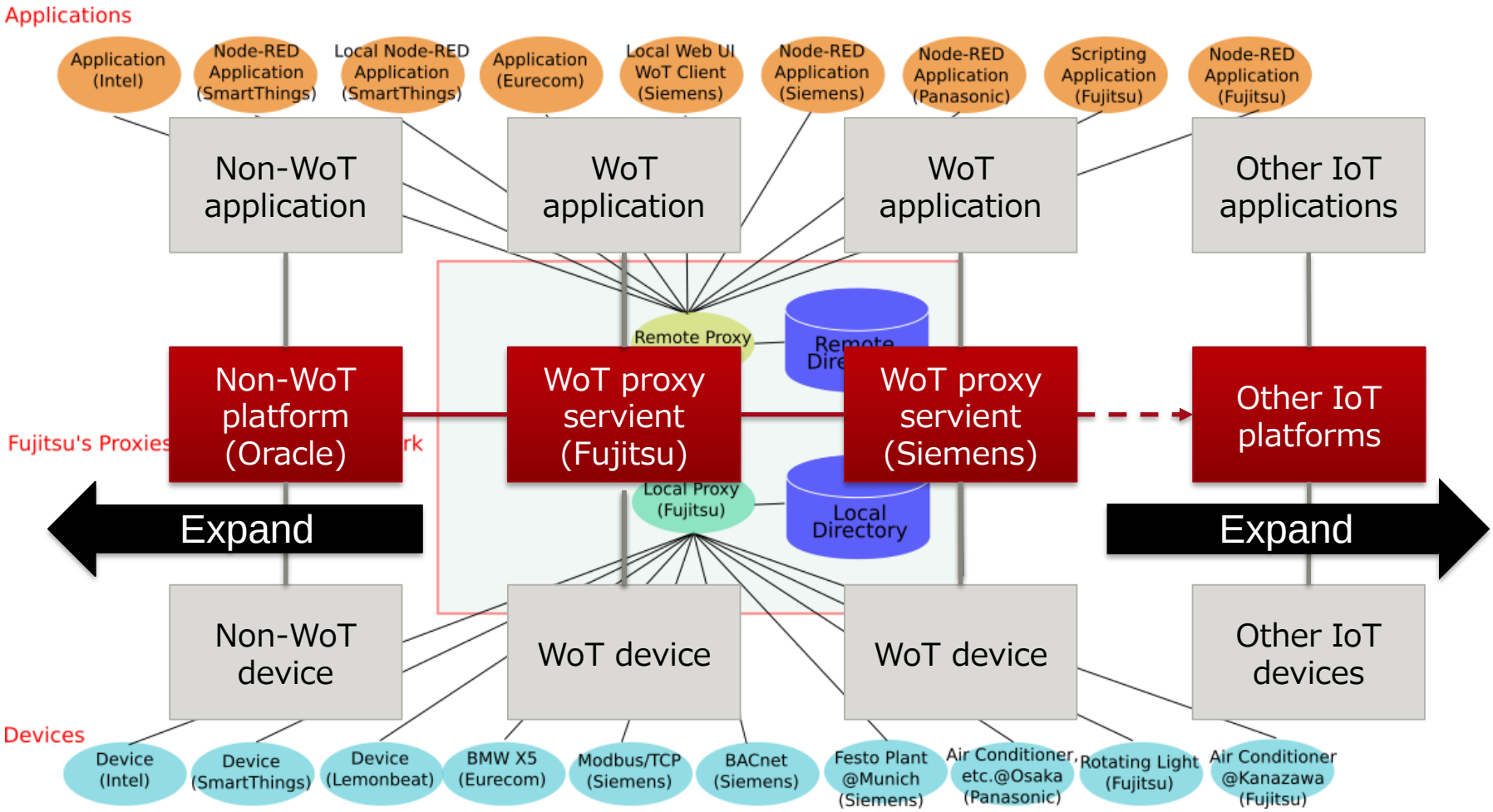
Various connection patterns for narrow waist model

- Proxies cooperation makes much more connections
  - Not only **WoT servients** but also **non-WoT** can be integrated.



Various connection patterns for narrow waist model

- Proxies cooperation makes much more connections
  - Not only **WoT servients** but also **non-WoT** can be integrated.



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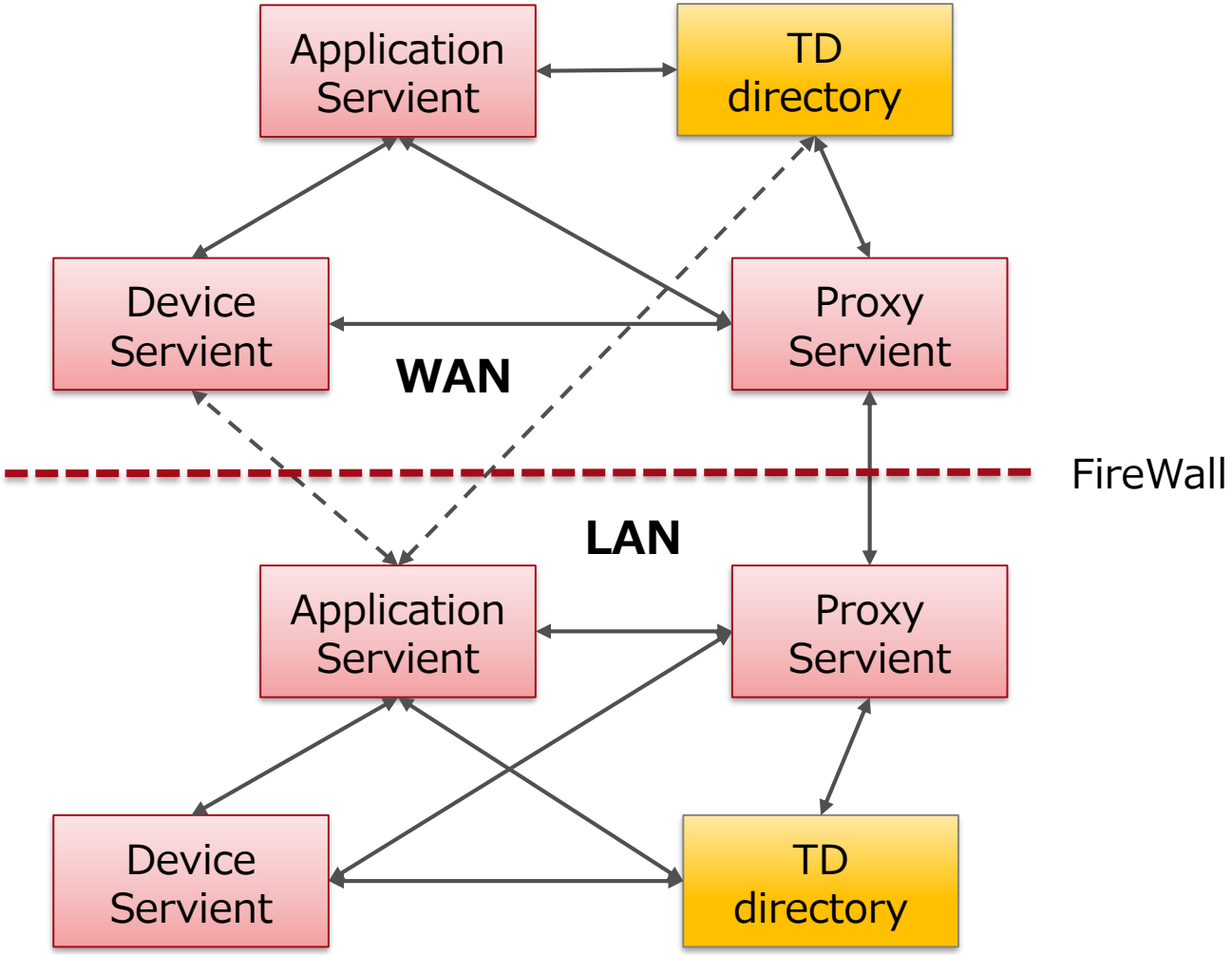
Various connection patterns for narrow waist model

- Consideration of possible configurations

System Architecture (Koster-san's slide)

- Proxy connect Servients on both of WAN and LAN.
  - Each TD directory provide TDs with proper URL.



System Architecture with Non-WoT

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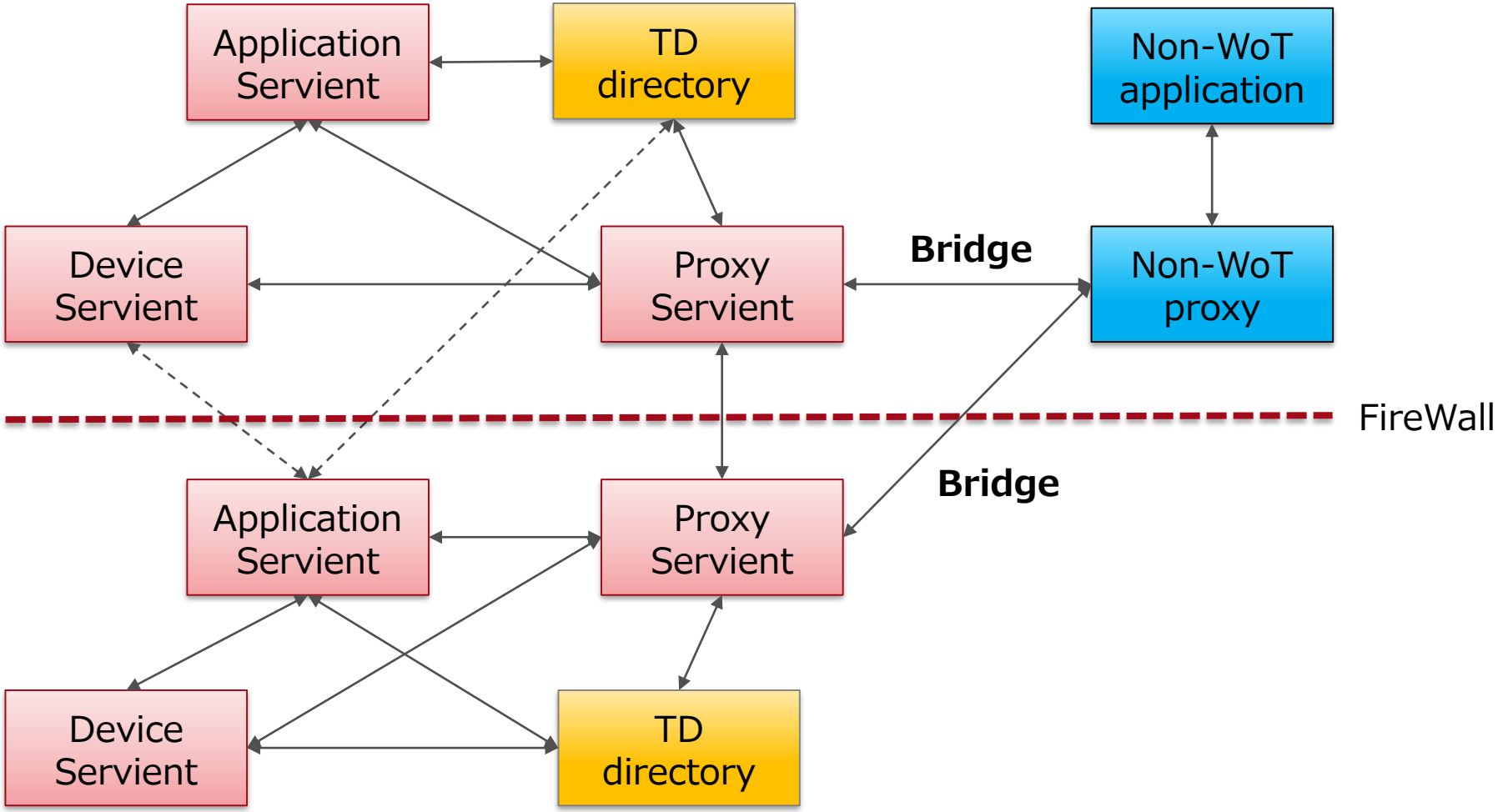
- Integration with Non-WoT proxy/application
  - Connected to Proxy Servient with bridge for Non-WoT entities



Servients integration

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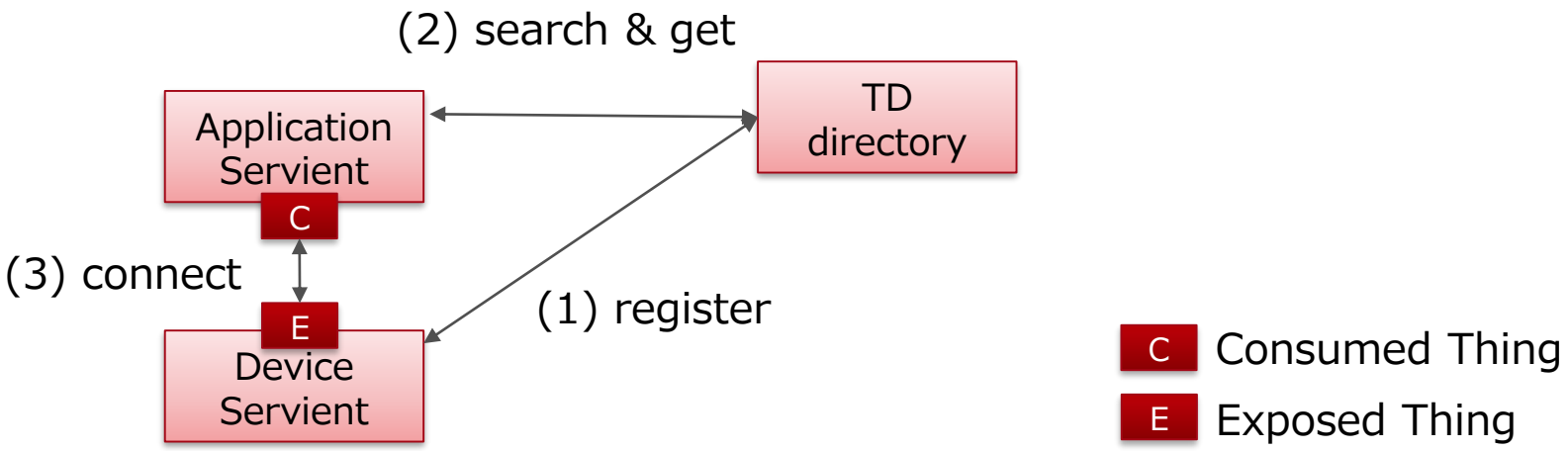
- Build up possible configurations of Servients
  - Combinations of application, device and proxy servients
  - Deployments and connections of servients
- Make clear the functions and interfaces of Servients

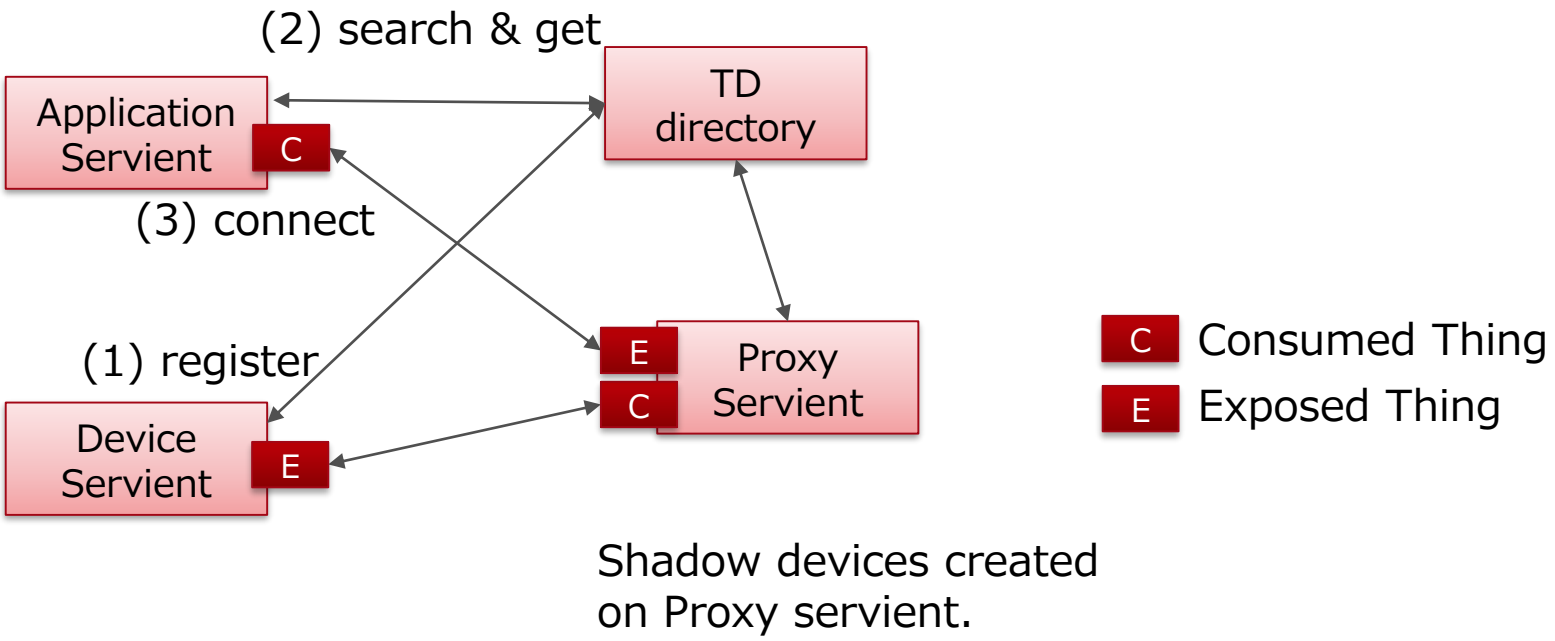
Use case: Application and Device

- Application Servient directly connect to Device Servient.
  - Device Servient registers own TD to the directory.
  - Application Servient searches and get TD of the device, and connects to the Device servient.



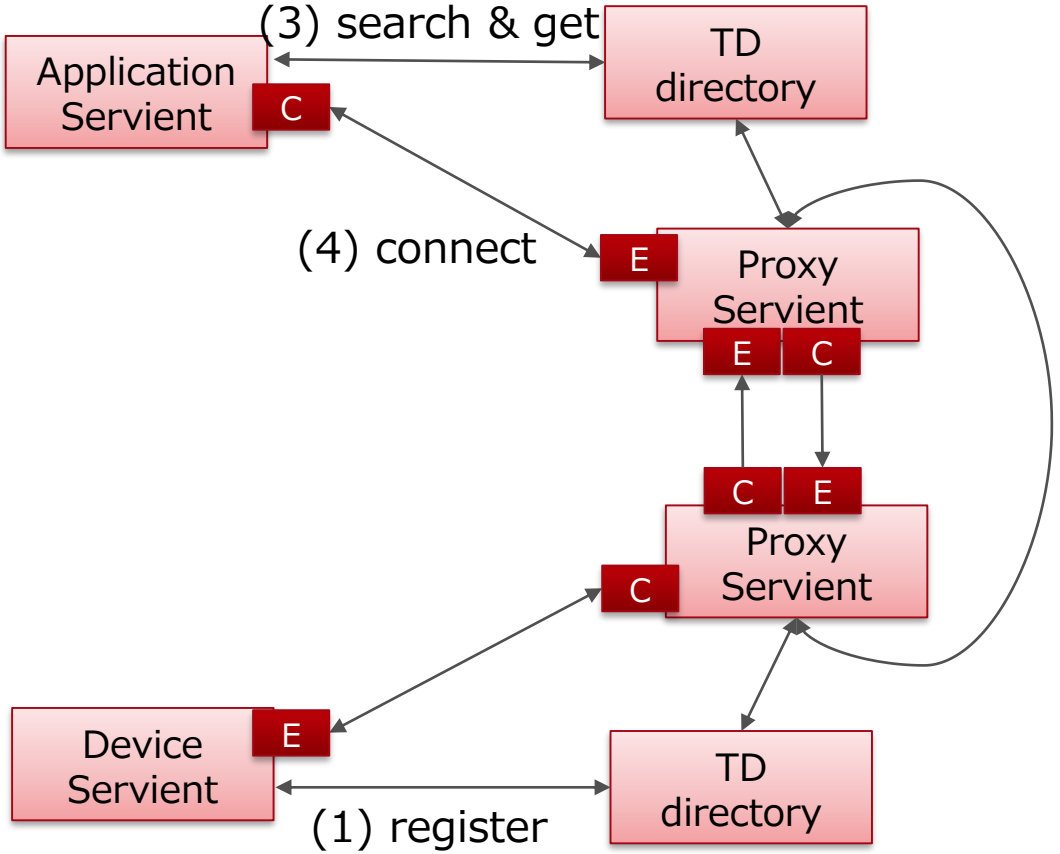
Use case: Proxy servient

- Application Servient connects to Device via Proxy.
  - Device Servient register own TD to the directory
  - Application Servient searches and get TD of the device, and connects to the Device Servient via Proxy Servient.



Use case: WAN app. and LAN device

- Application on WAN connects to Device on LAN via Proxy.
  - Local directory synchronizes TD of local device to Remote directory. TD on remote directory is globally accessible.

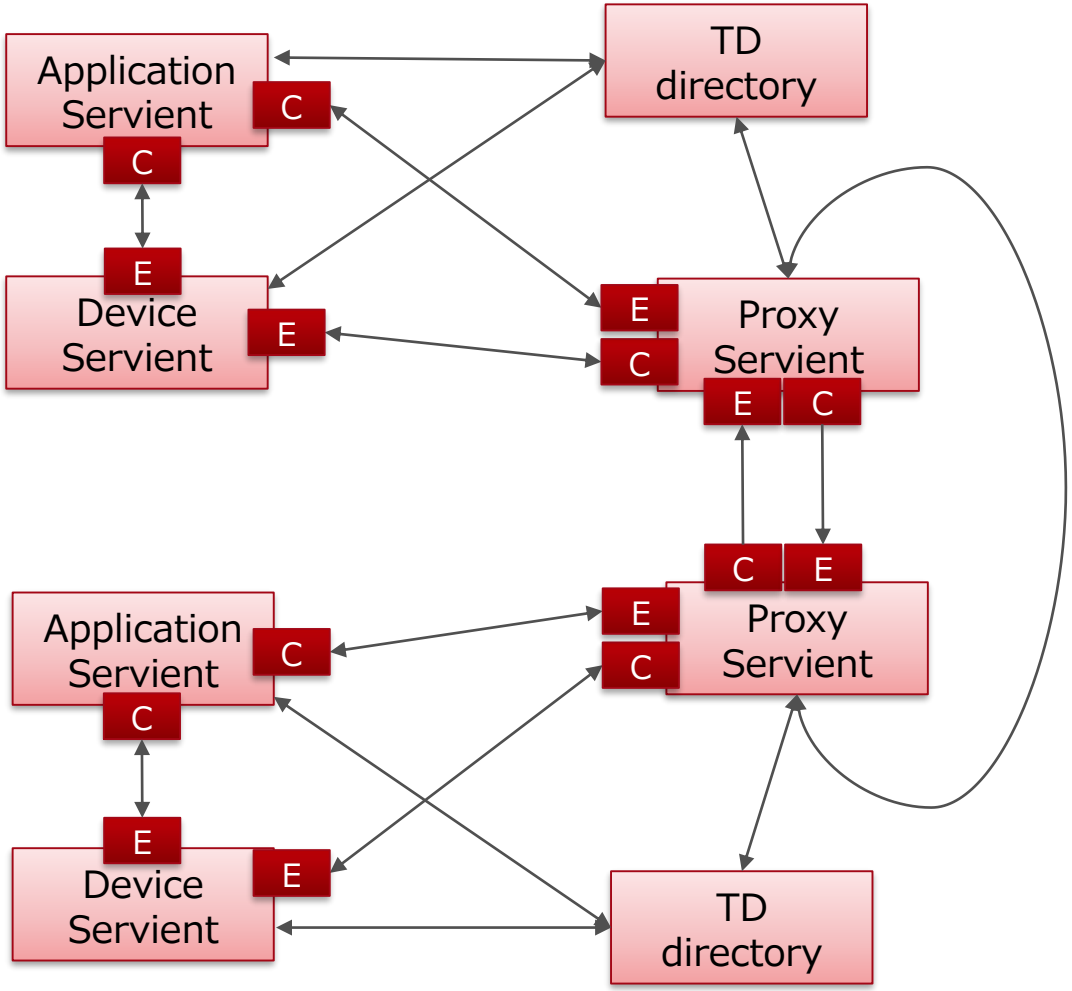


(2) Sync TD

Remote proxy servient generates URL corresponding to the local device servient for the remote application servient.

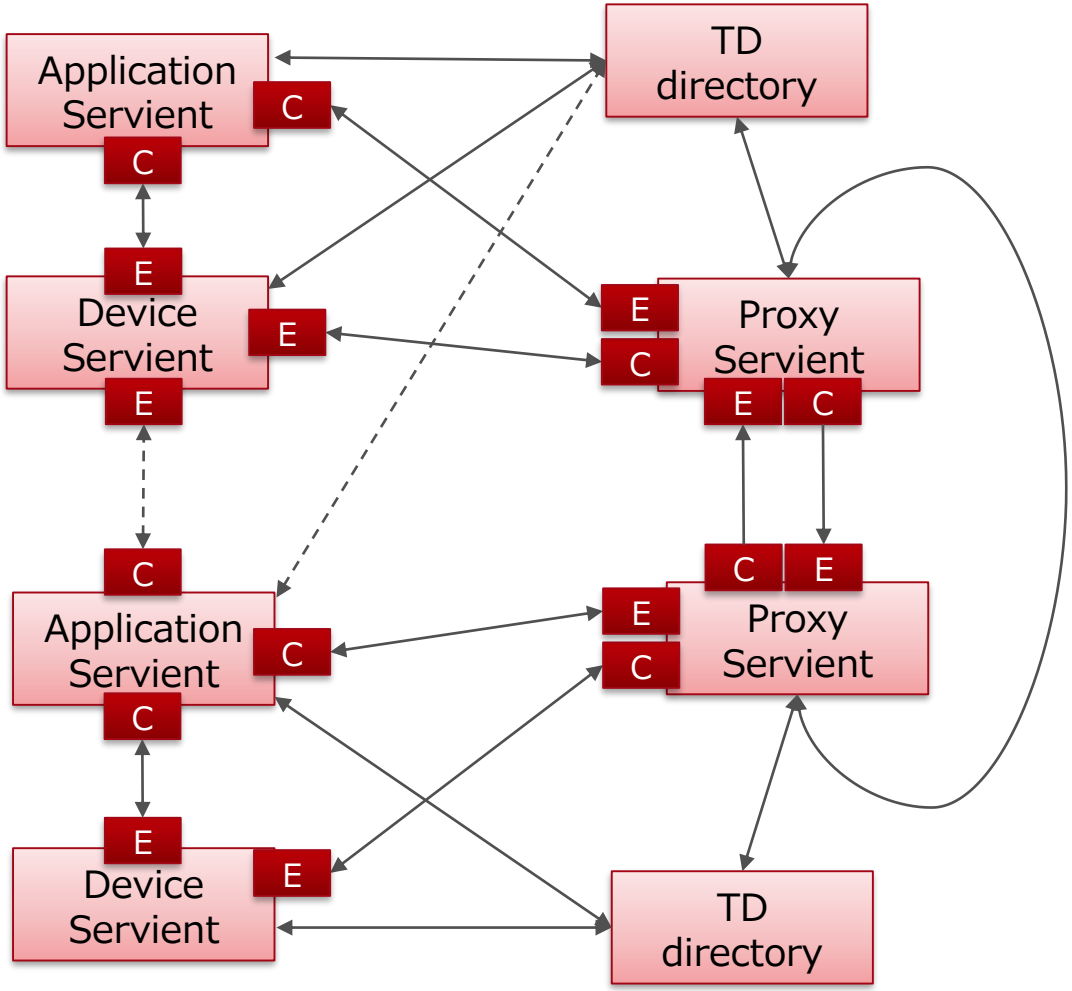
Integrated Servient architecture

- Possible configurations to integrate Servients for applications, devices and proxies.



Integrated Servient architecture

- Local applications can connect remote directory and devices.



Abstract interface definition for various connection patterns

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- Servient and TD directory abstract interfaces
  - Actual interfaces are defined by Binding template
  - Why don't you call the following interfaces "**WoT interface**" ?

Interfaces between Consumed and Exposed Thing

Consumed	direction	Exposed	
ReadProperty	→		
WriteProperty	→		
Subscribe	→		
	←	Event	
Action	→		

Interfaces between Servient and TD directory

Servient	direction	TD directory	
Register	→		Register TD to dir.
Lookup	→		Search and get TDs from dir.

Overview of sequence diagram (1/2)

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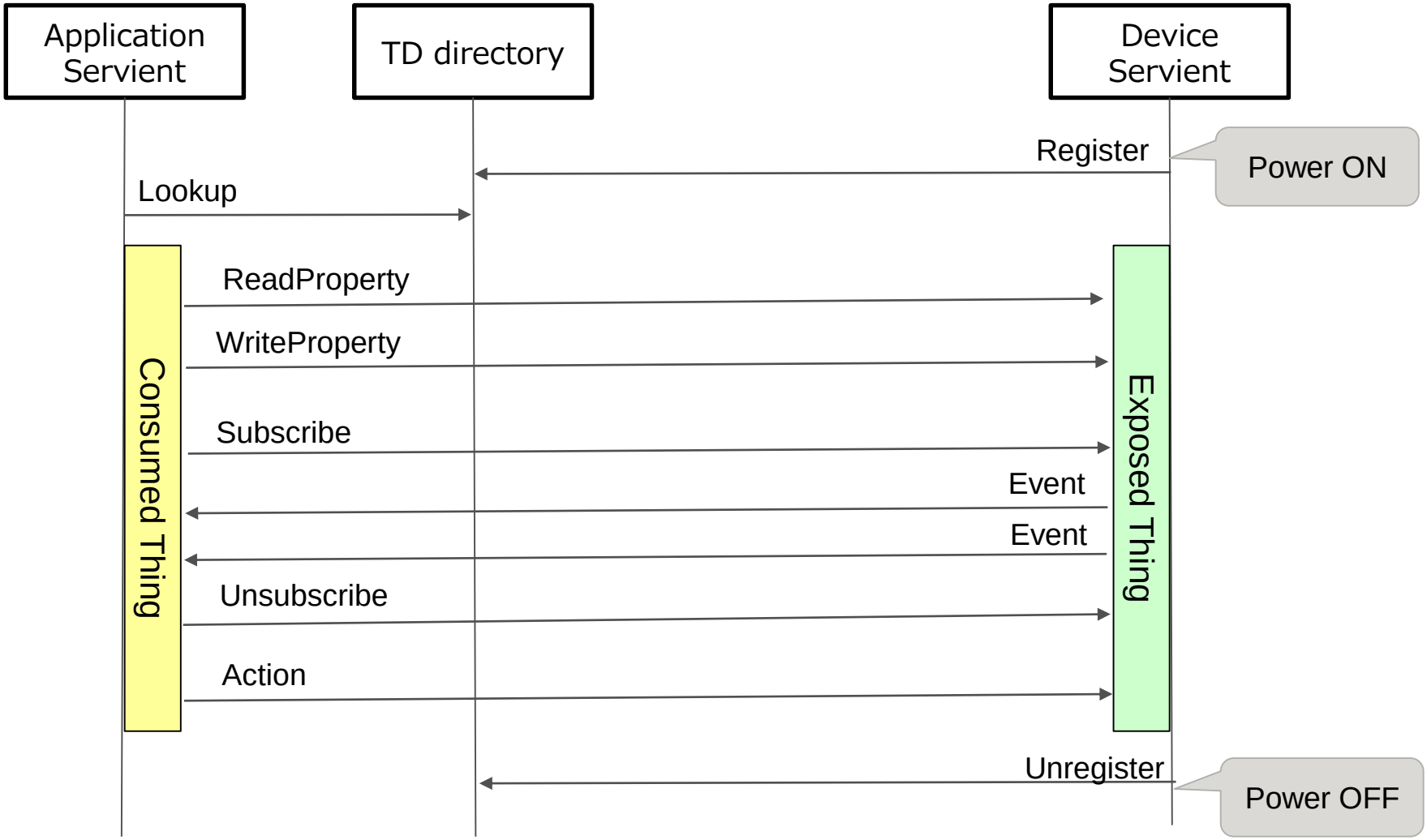
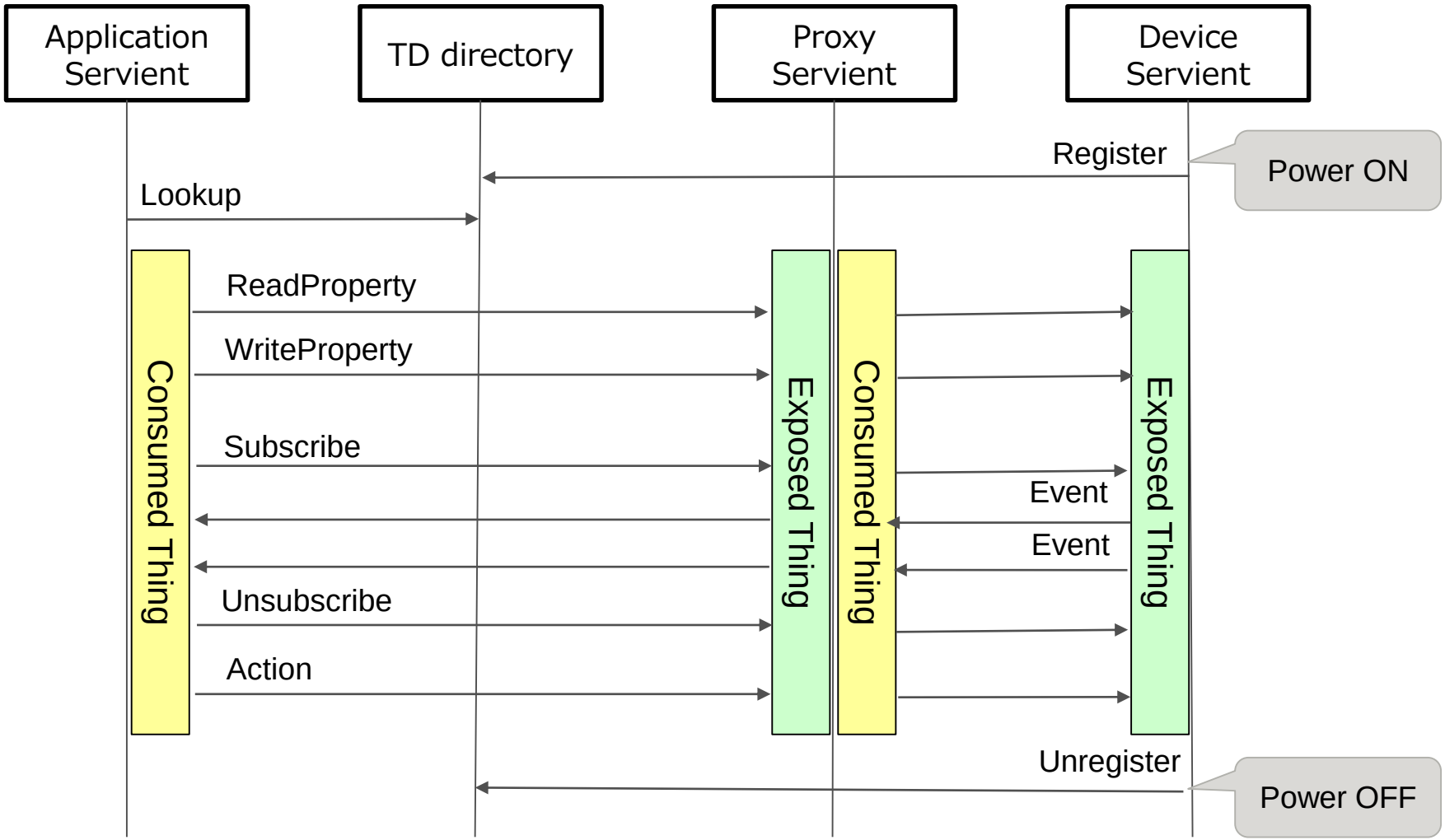
- Sequence of abstract interface between applications and devices.



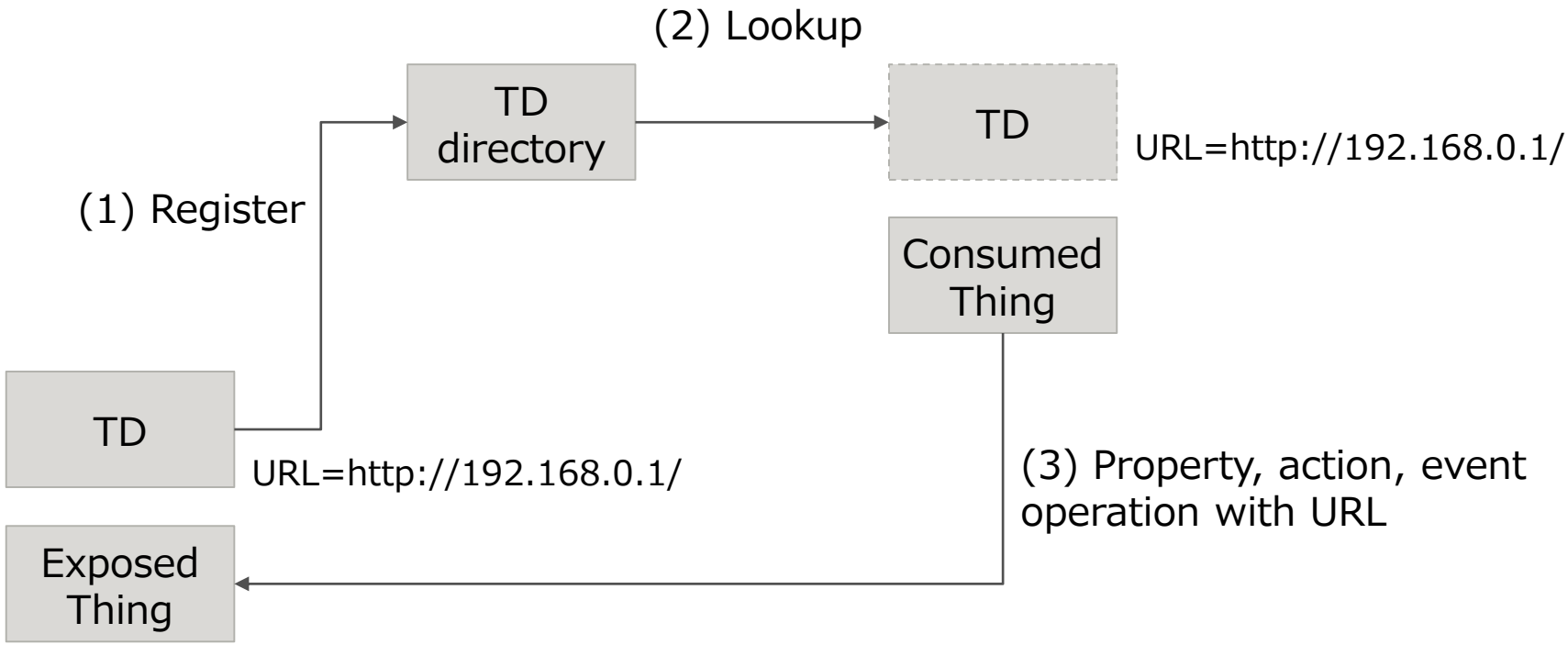
Overview of sequence diagram (2/2)

- Sequence of abstract interface with proxy servient.



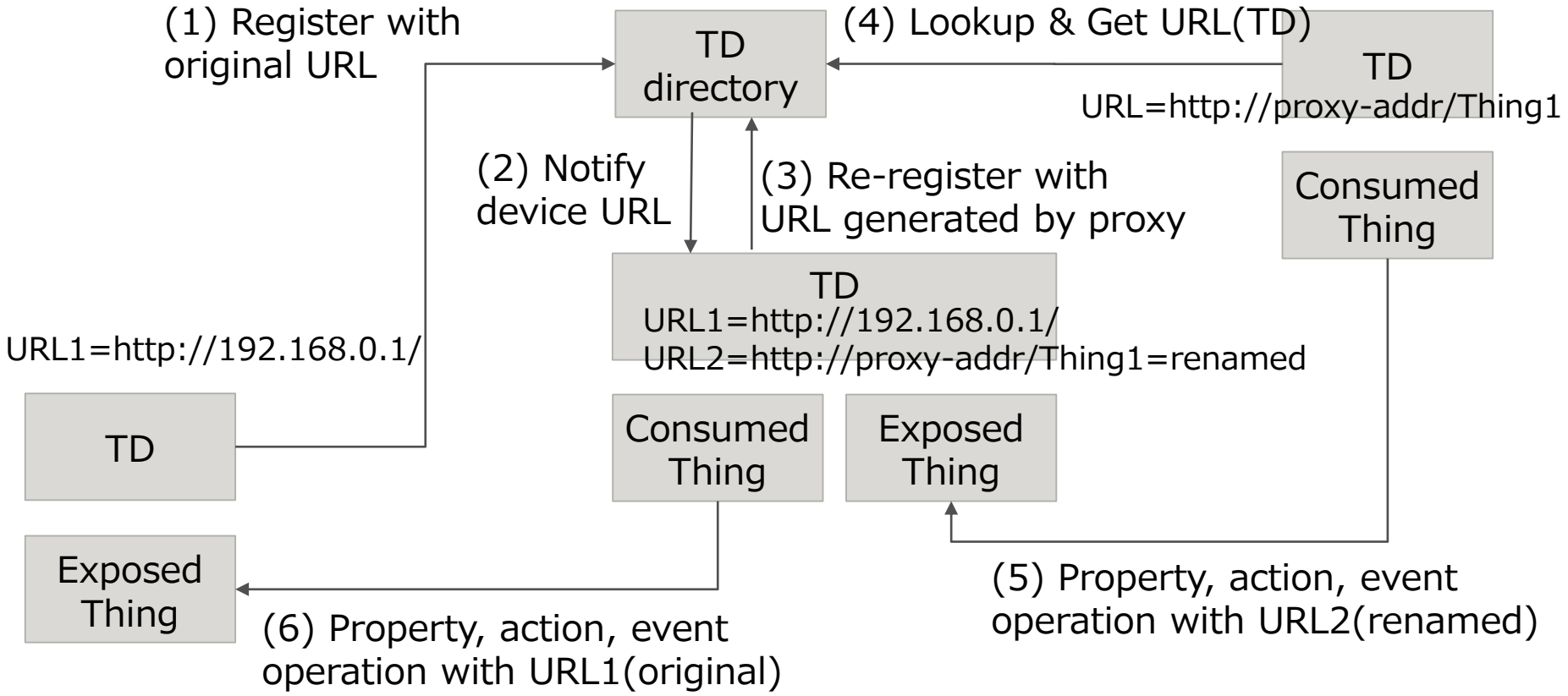
Address resolution on servients

- A device servient registers own TD with URL of the device to the directory.



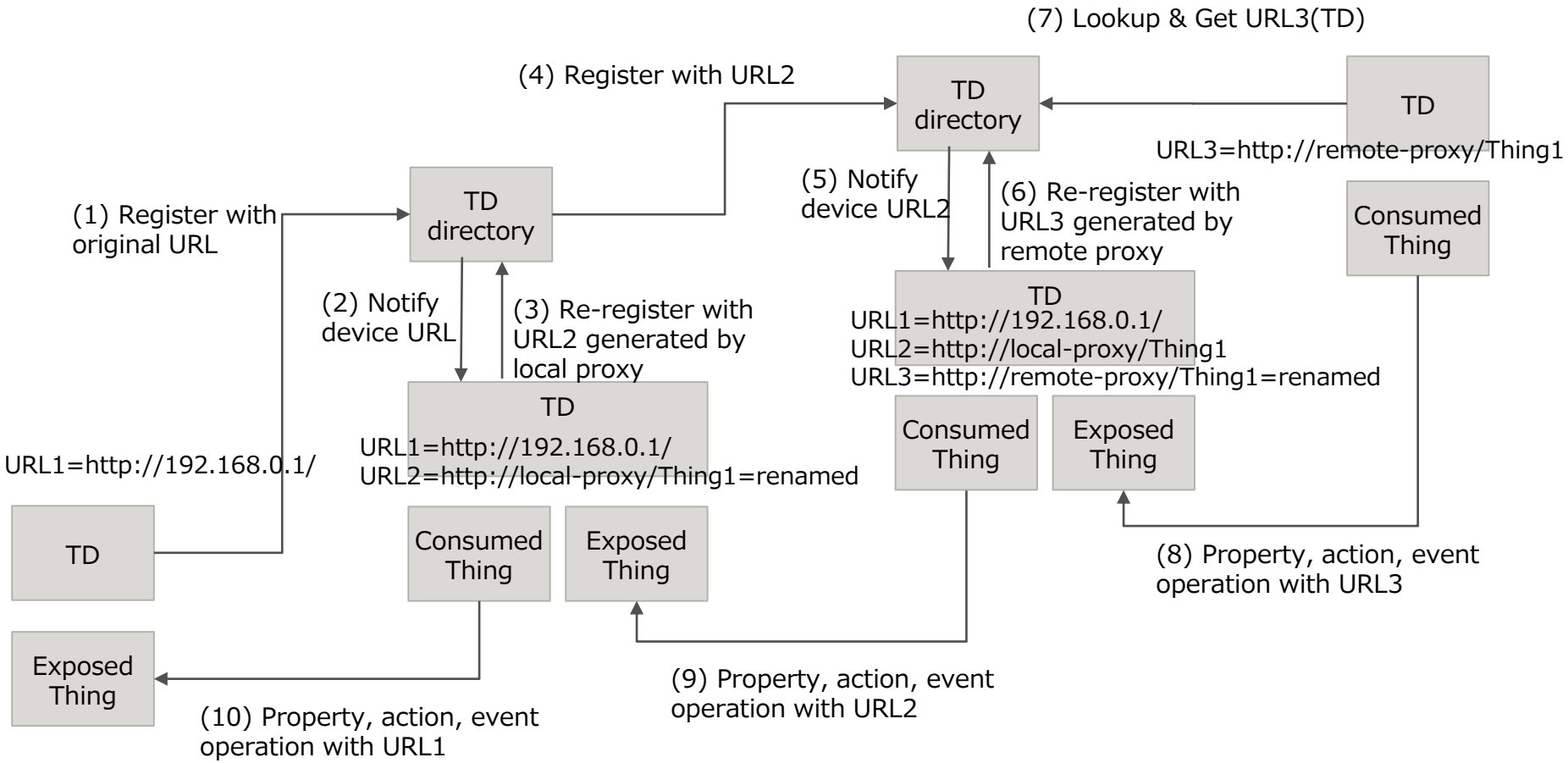
Address resolution with proxy servient

- Proxy servient needs to generate URL for redirection
- Management of multiple URL are required to proxy



Address resolution with remote/local proxy

- Proxy servient needs to generate URL for redirection



Device Servient **Local Proxy Servient** **Remote Proxy Servient** **Application Servient**

Interaction with non-WoT devices

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- WoT can coordinates with Non-WoT entities, such as applications, devices and IoT platforms.
- Bridge is transformation functions between WoT Servients and Non-WoT entities.

Device with non-WoT binding

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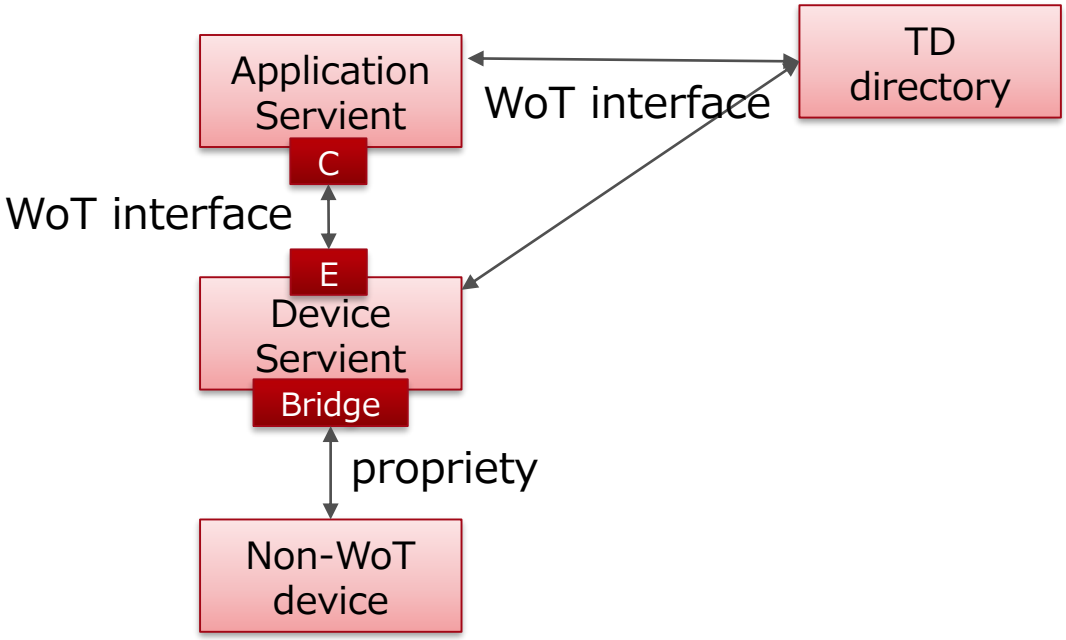
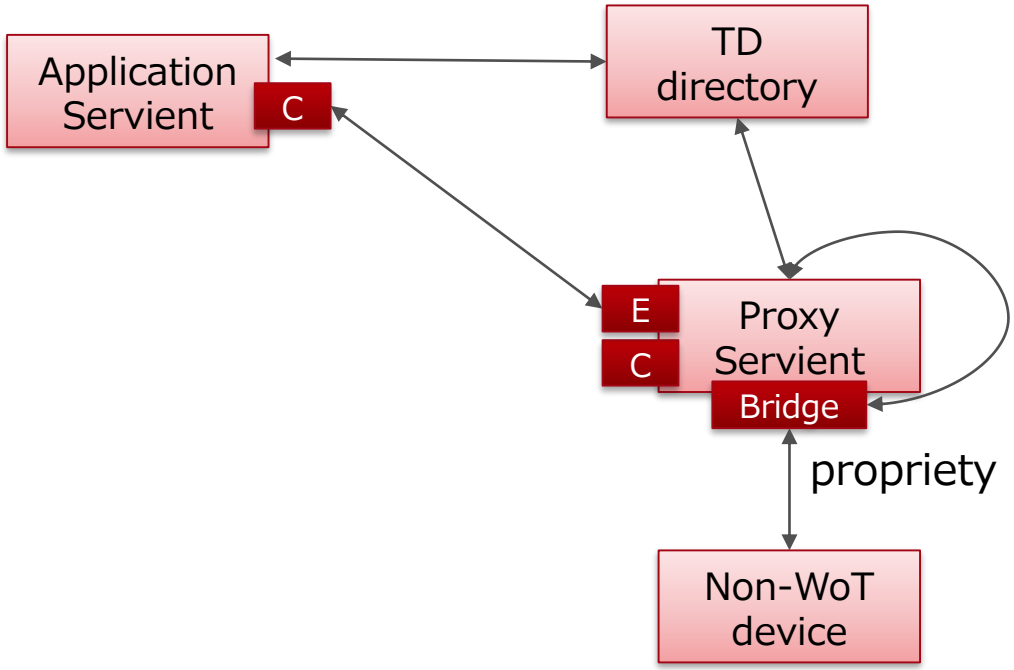
- Bridge can connect Device Servient and Non-WoT device.
  - Many Non-WoT devices have similar device models to Thing Description.
  - Device servient transforms Non-WoT interface (propriety) to WoT interface.



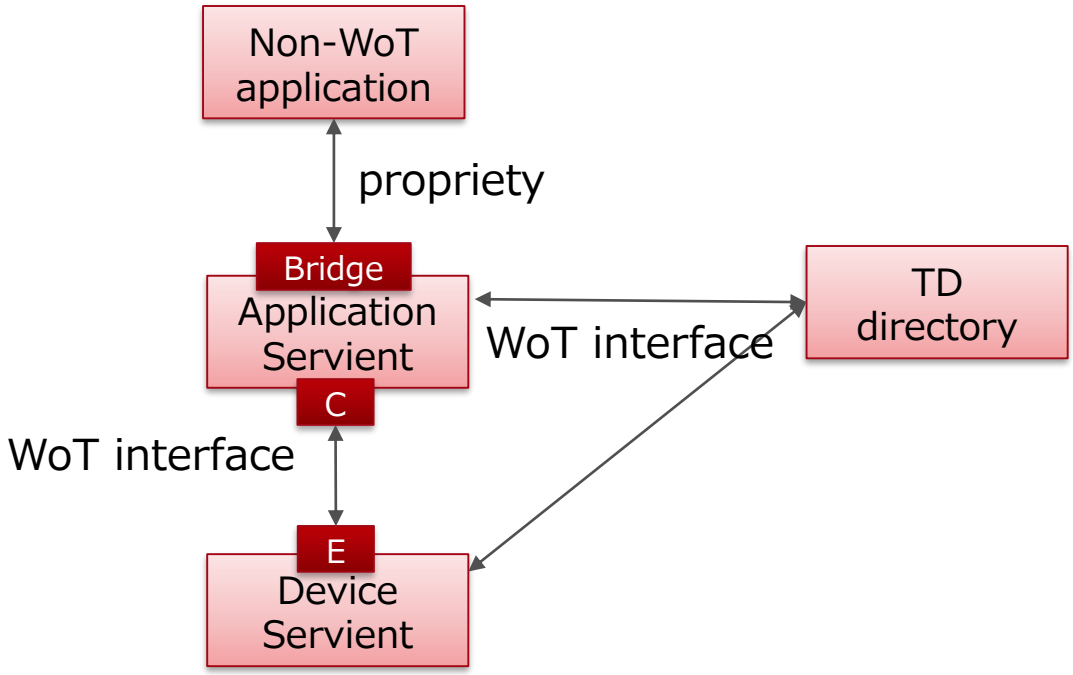
Proxy with Non-WoT device binding

- Bridge function can be implemented on proxy instead of device servient.



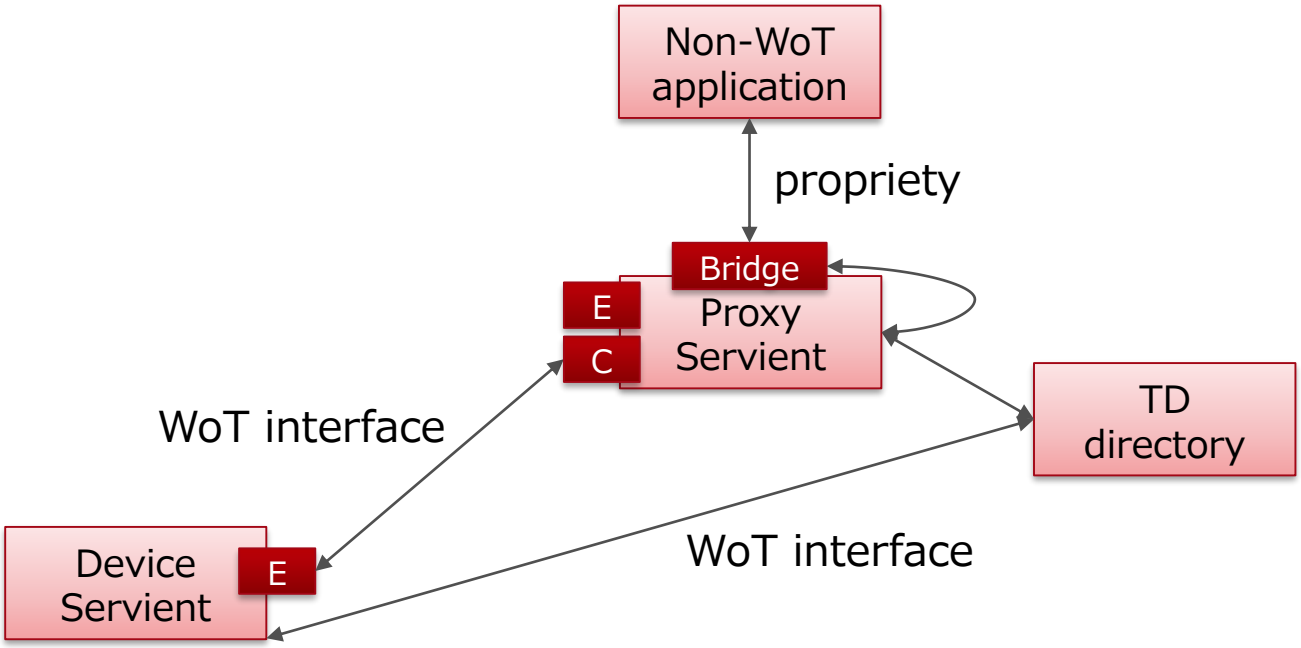
Application with Non-WoT binding

- Bridge can also connect Application Servient and Non-WoT application.
  - Many Non-WoT applications have similar device models to Thing Description.
  - Application servient transforms Non-WoT interface (propriety) to WoT interface.

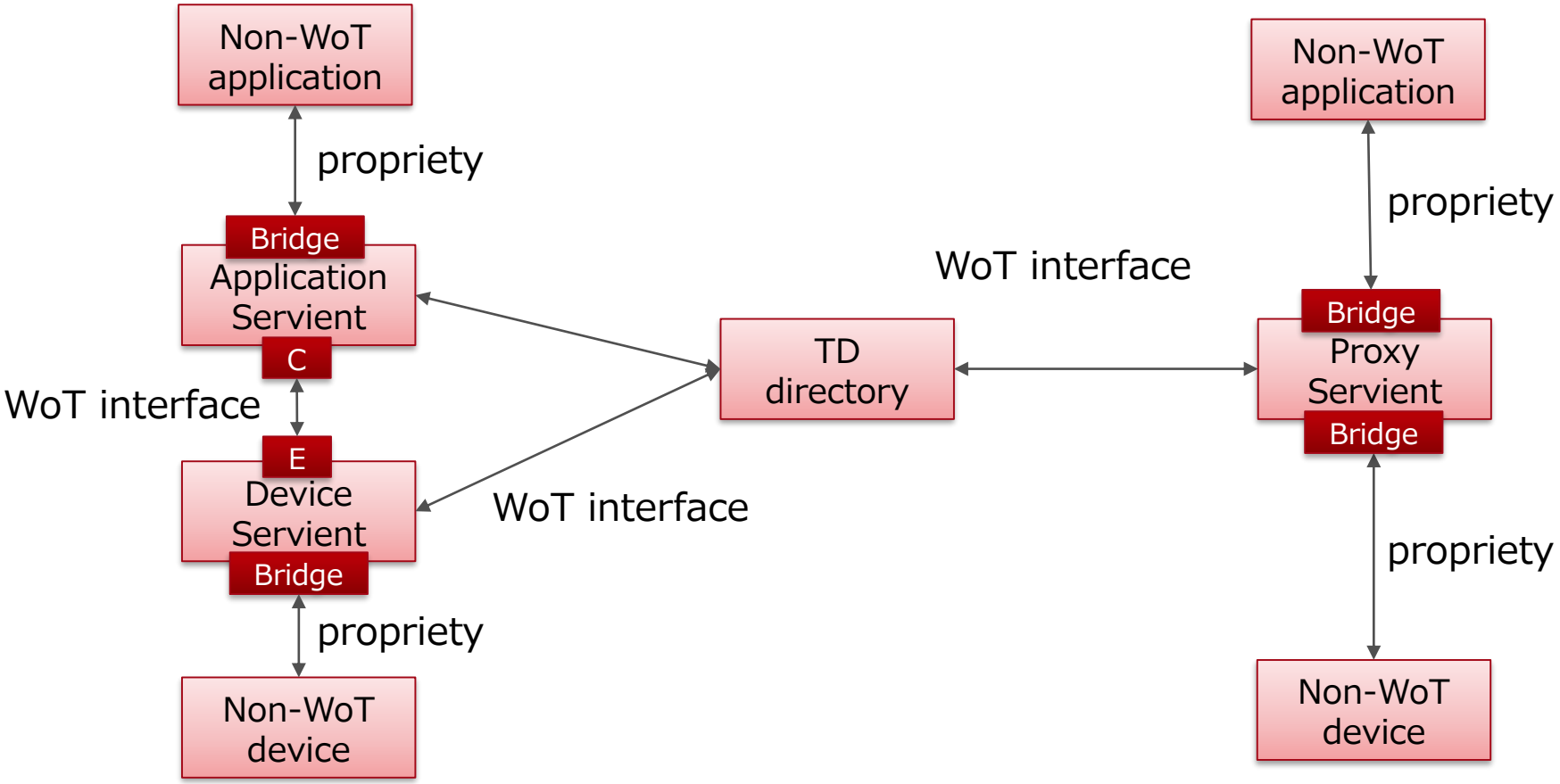


Proxy with Non-WoT binding

- Bridge function can be implemented on proxy instead of application servient.

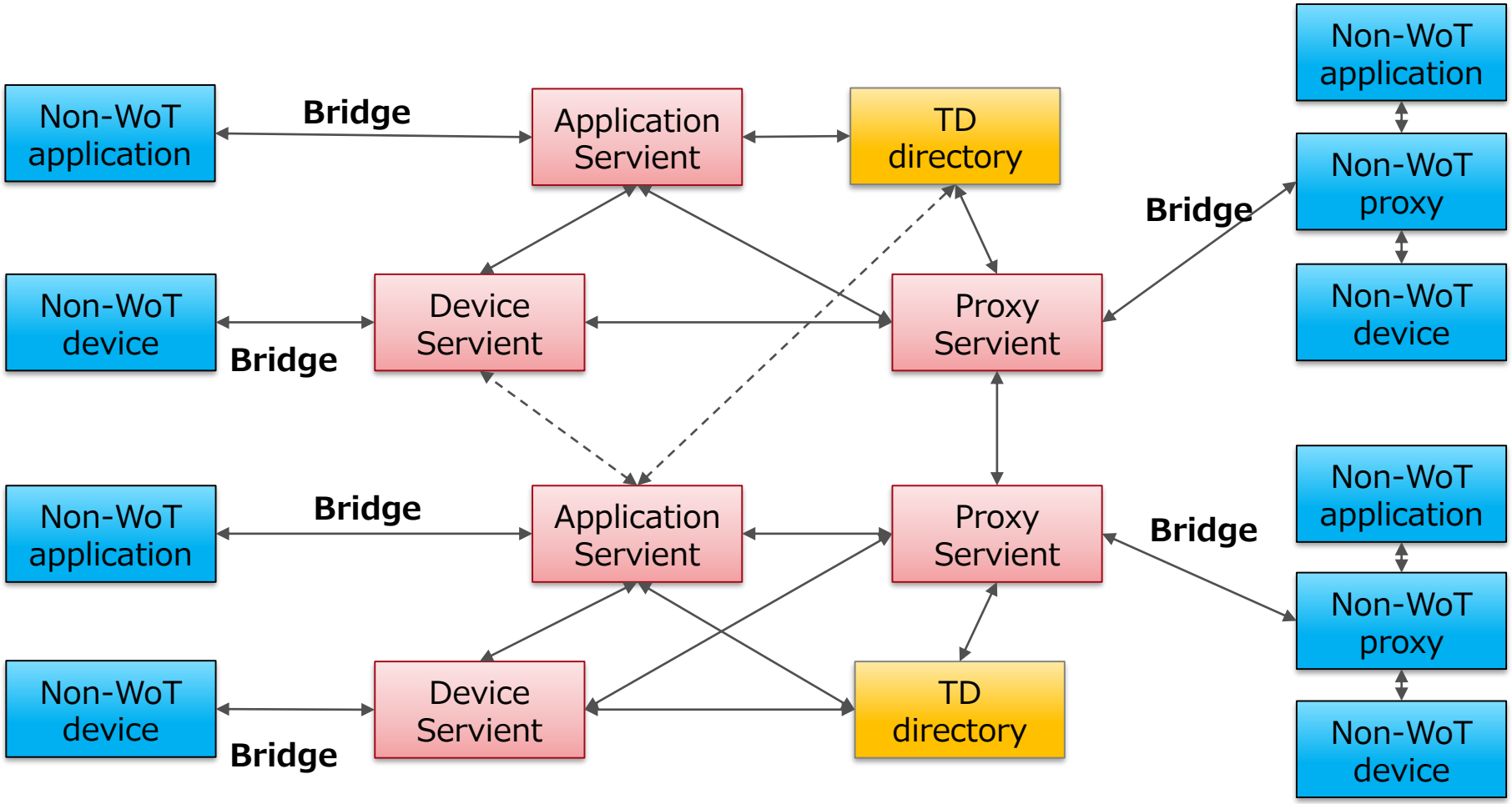


Possible configurations with bridges



System Architecture with Non-WoT

- Integration with Non-WoT proxy/application
  - Connected to Proxy Servient with bridge for Non-WoT entities



Proposals

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- Update architecture documents
  - Possible configurations with applications, devices and proxies.
  - Guideline to coordinate WoT Servient and Non-WoT entities.
  - Sequence diagrams of Integrated Servients with abstract interfaces.

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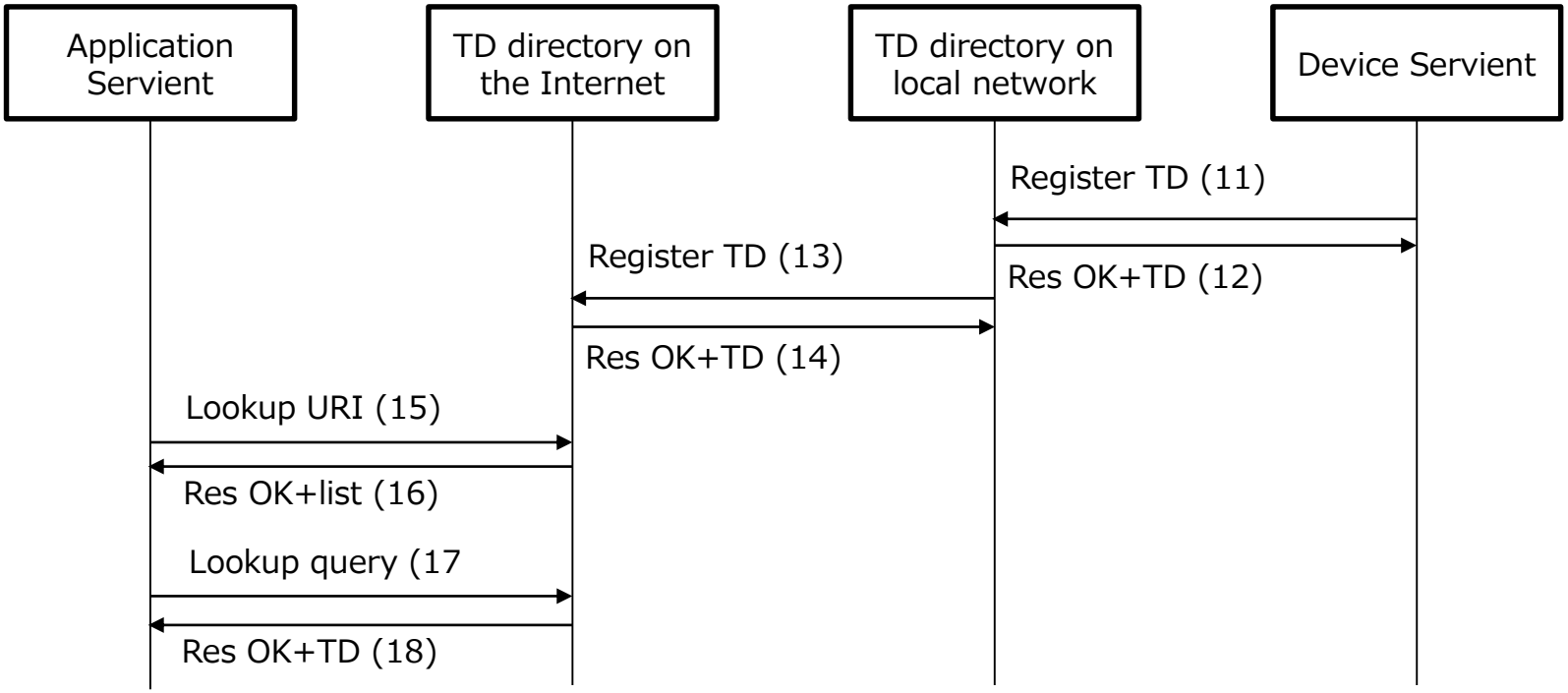
Sequence diagrams with abstract WoT interfaces

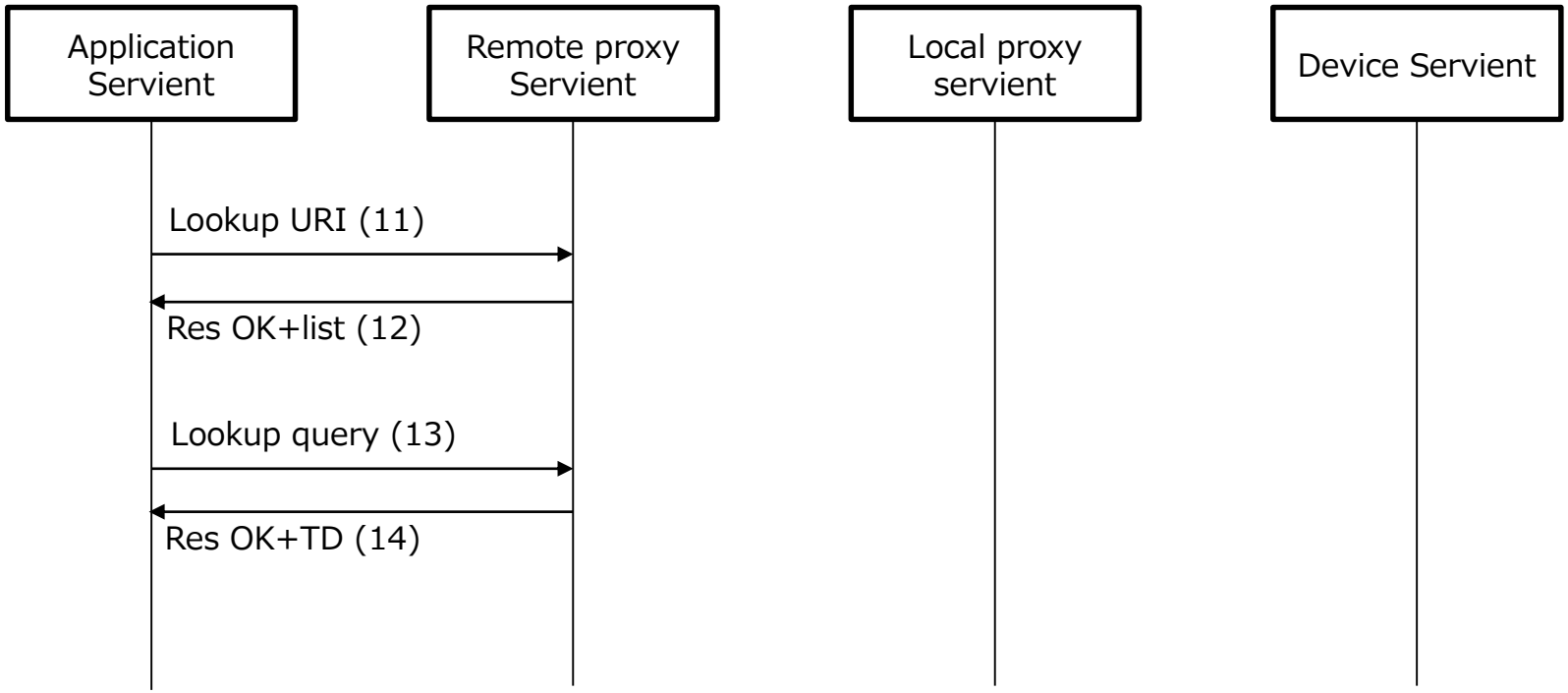
Register

- A device servient is registered to the local proxy servient and remote proxy servient. The proxy servient returned the TD with public uri. The proxy servients have TD repositories to store TDs registered from the other servients.



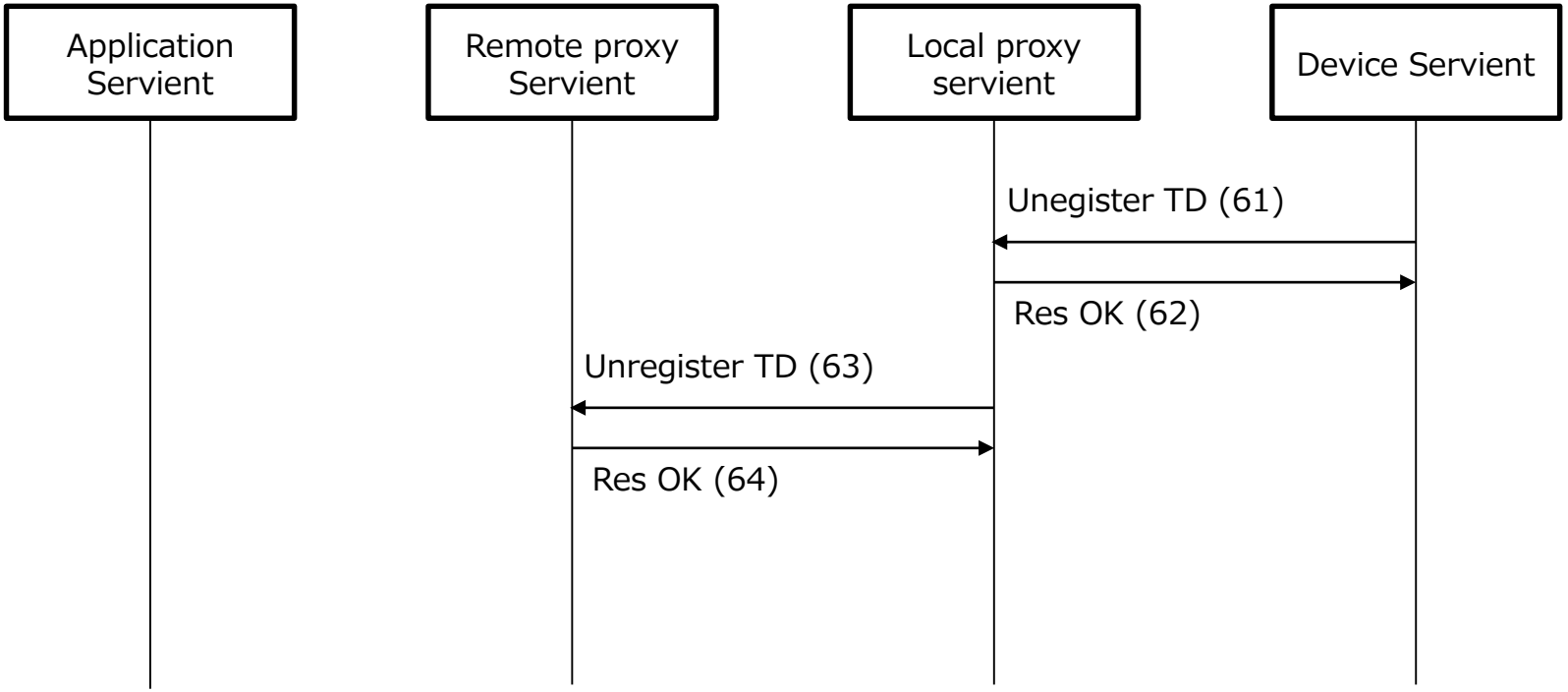
Lookup

- An application servient can lookup TDs registered the remote proxy servient with its URI. If the URI indicates the servient, it returns the list of the devices connected. If the URI specifies the devices registered on the proxy servient, it returns TD of it.



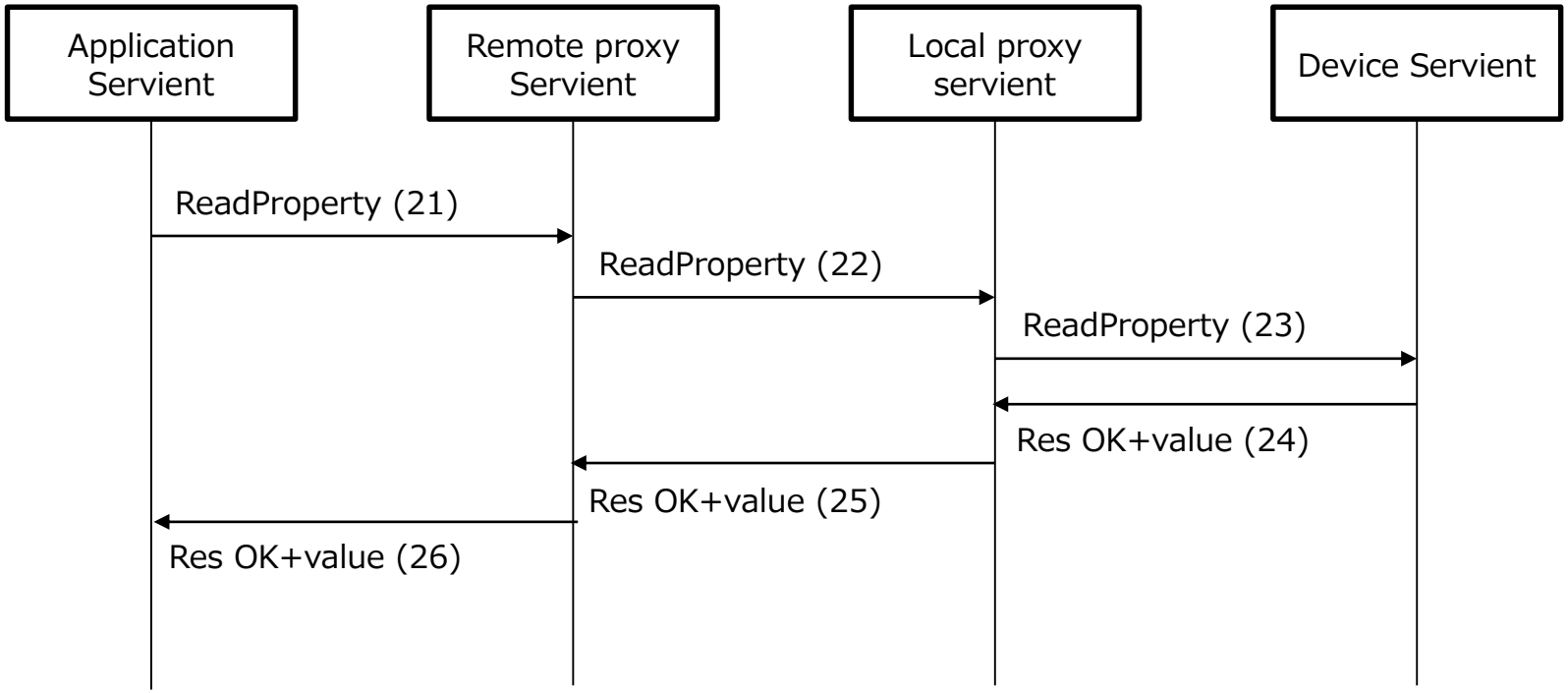
Unregister

- The device servient unregister from the local proxy servient before shutdown. The local proxy servient unregister this device servient from the remote proxy not to access from the application.



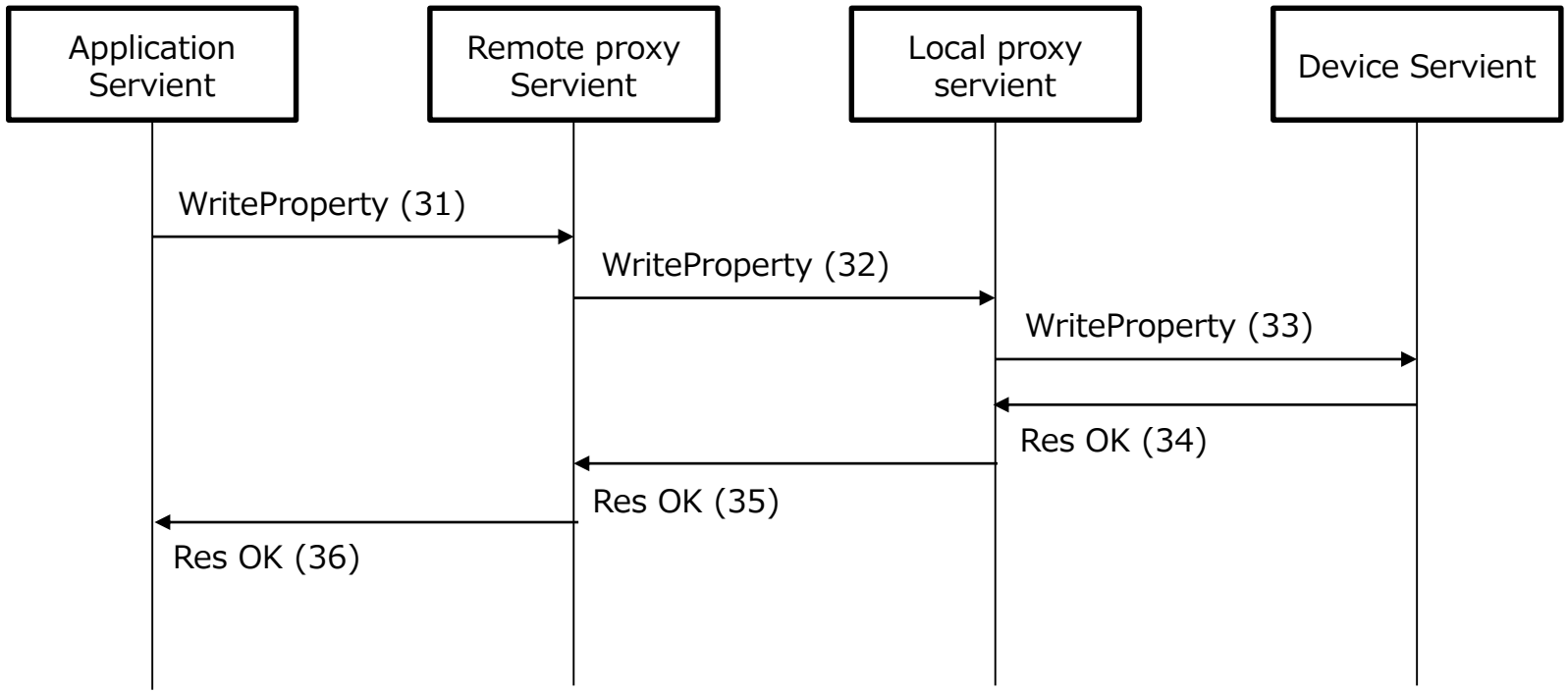
ReadProperty

- The application servient sends a request to read the value of the property of the device servient to the remote proxy servient. The remote and local proxy servient relay to this request to the device servient.



WriteProperty

- The application servient sends a request to write the value to the property of the device servient to the remote proxy servient. The remote and local proxy servient relay to this request to the device servient.



Subscribe and Event with long polling

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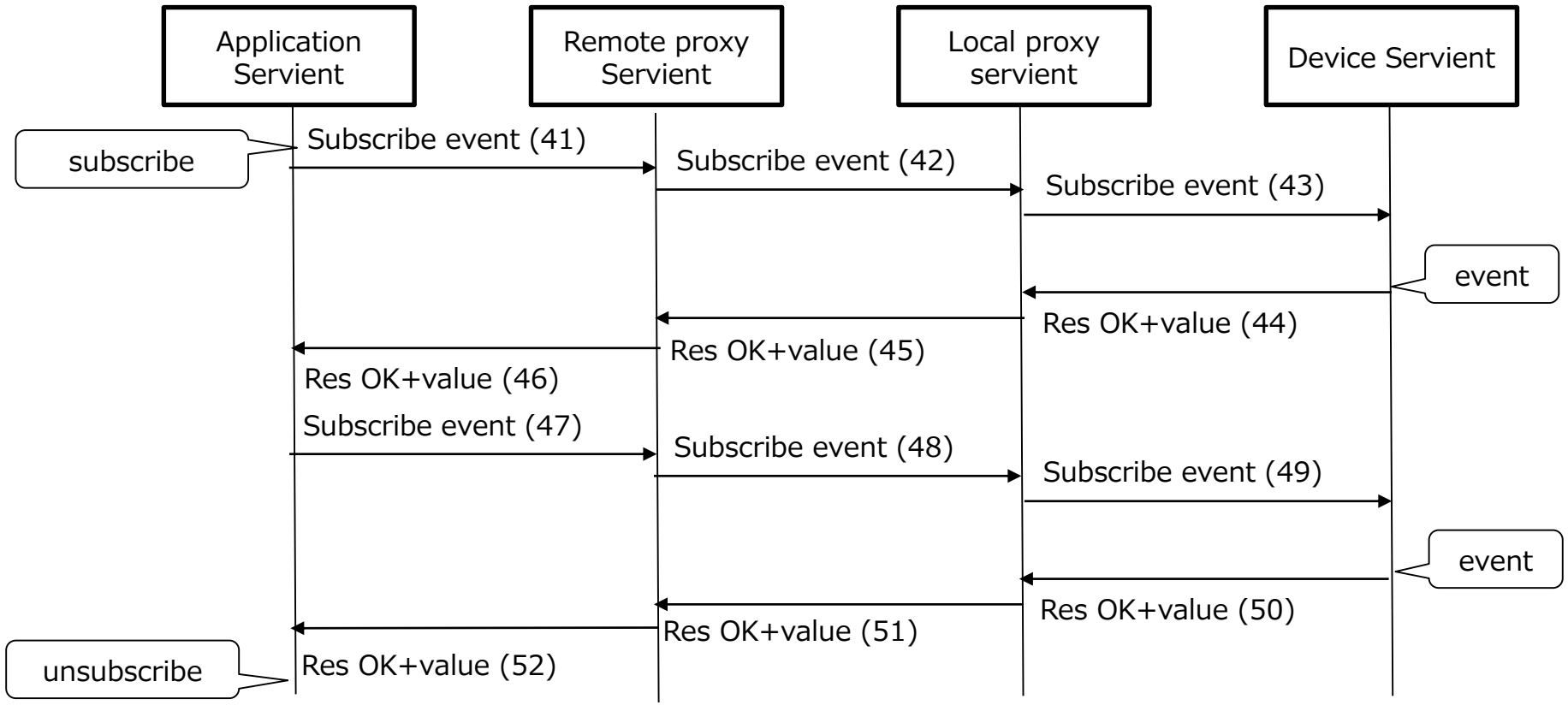
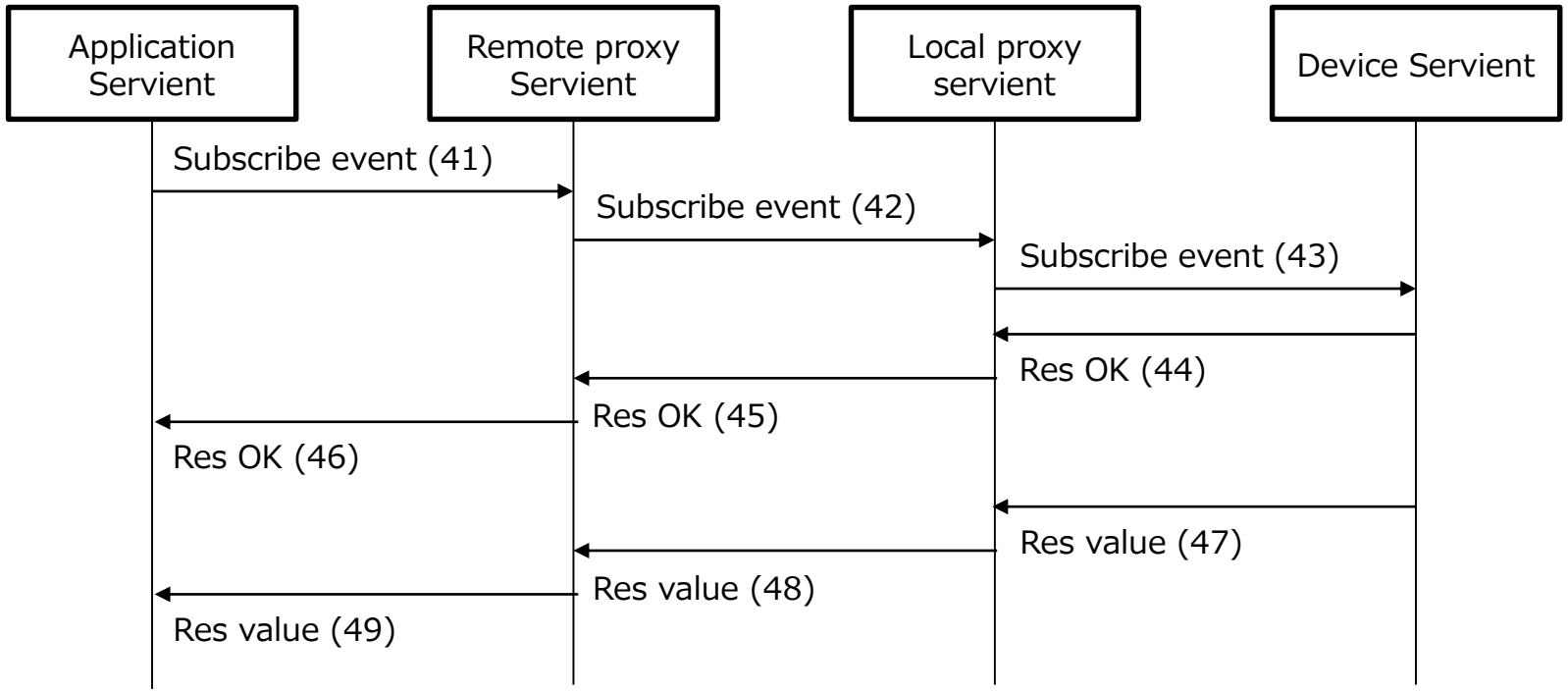
- The application servient sends a request to subscribe the property of the device servient to the remote proxy servient. The device servient keep to send the value of the specified property periodically or when some events happen until the application unsubscribes.



Subscribe and event with Server Sent Event method

- The application servient can obtain the change or the current status of the device servient via proxy servient using subscription procedures. The application servient sends a request to subscribe the property of the device servient via the remote and local proxy servient. The device servient keep to send the value of the specified property periodically or when some events happen.



Unsubscribe

- The application servient sends a request to unsubscribe to the remote proxy servient to stop to notify the event from the device servient.