Ford Motor (China) Company

SDL 中 SetDisplayLayout 流程分析

Version <1.0>

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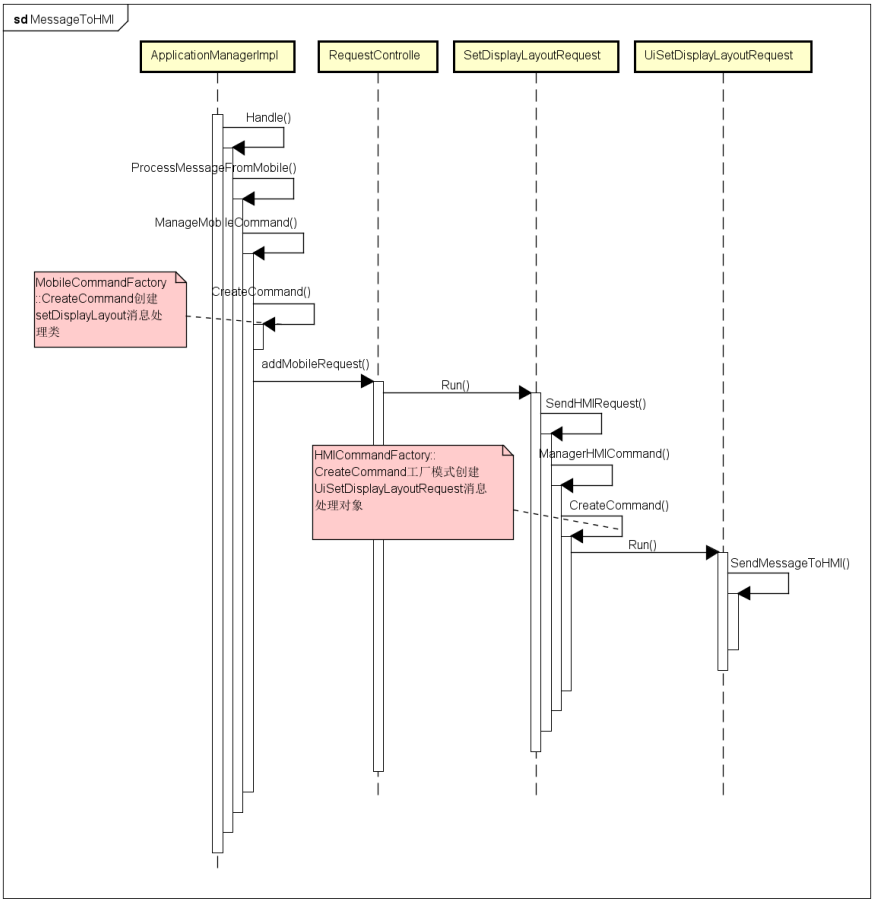
修改历史

版本	日期	说明
1.0.0	2017-11-20	初版，完成文档架构，填写文档内容
1.0.1	2017-11-24	增加流程图

目录

1 消息发送流程



2 MessageFromMobile 消息处理

2.1 Handle

```
void ApplicationManagerImpl::Handle(const impl::MessageFromMobile message) {
  LOG4CXX_AUTO_TRACE(logger_);

  if (!message) {
    LOG4CXX_ERROR(logger_, "Null-pointer message received.");
    return;
  }
  sync_primitives::AutoLock lock(stopping_flag_lock_);
  if (is_stopping_) {
    LOG4CXX_INFO(logger_, "Application manager is stopping");
    return;
  }
  ProcessMessageFromMobile(message);
}
```

2.2 ProcessMessageFromMobile

```
void ApplicationManagerImpl::ProcessMessageFromMobile(
    const utils::SharedPtr<Message> message) {
  LOG4CXX_AUTO_TRACE(logger_);
#ifdef TELEMETRY_MONITOR
  AMTelemetryObserver::MessageMetricSharedPtr metric(
      new AMTelemetryObserver::MessageMetric());
  metric->begin = date_time::DateTime::getCurrentTime();
#endif  // TELEMETRY_MONITOR
  smart_objects::SmartObjectSPtr so_from_mobile(new smart_objects::SmartObject);

  if (!so_from_mobile) {
    LOG4CXX_ERROR(logger_, "Null pointer");
    return;
  }

  if (!ConvertMessageToSO(*message, *so_from_mobile)) {
    LOG4CXX_ERROR(logger_, "Cannot create smart object from message");
    return;
  }
#ifdef TELEMETRY_MONITOR
  metric->message = so_from_mobile;
#endif  // TELEMETRY_MONITOR

  if (!ManageMobileCommand(so_from_mobile, commands::Command::ORIGIN_MOBILE)) {
    LOG4CXX_ERROR(logger_, "Received command didn't run successfully");
  }
#ifdef TELEMETRY_MONITOR
  metric->end = date_time::DateTime::getCurrentTime();
  if (metric_observer_) {
    metric_observer_->OnMessage(metric);
  }
#endif  // TELEMETRY_MONITOR
}
```

2.3 ManageMobileCommand

```
bool ApplicationManagerImpl::ManageMobileCommand(
    const commands::MessageSharedPtr message,
    commands::Command::CommandOrigin origin) {
  LOG4CXX_AUTO_TRACE(logger_);

  if (!message) {
    LOG4CXX_WARN(logger_, "Null-pointer message received.");
    return false;
  }

  if (IsLowVoltage()) {
    LOG4CXX_WARN(logger_, "Low Voltage is active");
    return false;
  }
#ifdef DEBUG
  MessageHelper::PrintSmartObject(*message);
#endif

  LOG4CXX_DEBUG(logger_, "T                                              ;
  utils::SharedPtr<commands::Command> command(
      MobileCommandFactory::CreateCommand(message, origin));
```

MobileCommandFactory::CreateCommand 工厂模式根据 RPC 定义的 ID 和消息来源创建对应 RPC 消息处理对象

2.4 RequestController

setDisplayLayout 的请求类型会将 command 加入到请求控制器（RequestController）中进行处理

```
if (message_type == mobile_apis::messageType::request) {
  // commands will be launched from requesr_ctrl
  mobile_apis::HMILevel::eType app_hmi_level =
      mobile_apis::HMILevel::INVALID_ENUM;
  if (app) {
    app_hmi_level = app->hmi_level();
  }

  // commands will be launched from request_ctrl

  const request_controller::RequestController::TResult result =
      request_ctrl_.addMobileRequest(command, app_hmi_level);
```

3 RequestController

setDisplayLayout 请求被加入到 RequestController 中，通过 request_ptr->Run();调用内部处理模块

```
void RequestController::Worker::threadMain() {
  LOG4CXX_AUTO_TRACE(logger_);
  AutoLock auto_lock(thread_lock_);
  while (!stop_flag_) {
    // Try to pick a request
    AutoLock auto_lock(request_controller_->mobile_request_list_lock_);

    while ((request_controller_->pool_state_ != TPoolState::STOPPED) &&
           (request_controller_->mobile_request_list_.empty())) {
      // Wait until there is a task in the queue
      // Unlock mutex while wait, then lock it back when signaled
      LOG4CXX_INFO(logger_, "Unlocking and waiting");
      request_controller_->cond_var_.Wait(auto_lock);
      LOG4CXX_INFO(logger_, "Signaled and locking");
    }

    // If the thread was shutdown, return from here
    if (request_controller_->pool_state_ == TPoolState::STOPPED) {
      break;
    }

    if (request_controller_->mobile_request_list_.empty()) {
      LOG4CXX_WARN(logger_, "Mobile request list is empty");
      break;
    }

   RequestPtr request_ptr( request_controller_->mobile_request_list_.front());
   request_controller_->mobile_request_list_.pop_front();

    bool init_res = request_ptr->Init();  // to setup specific
                                                    // default timeout

    const uint32_t timeout_in_mseconds = request_ptr->default_timeout();
    RequestInfoPtr request_info_ptr(new MobileRequestInfo(request_ptr,
                                                          timeout_in_mseconds));

    request_controller_->waiting_for_response_.Add(request_info_ptr);
    LOG4CXX_DEBUG(logger_, "timeout_in_mseconds " << timeout_in_mseconds);

    if (0 != timeout_in_mseconds) {
      request_controller_->UpdateTimer();
    } else {
      LOG4CXX_DEBUG(logger_, "Default timeout was set to 0. "
                    "RequestController will not track timeout "
                    "of this request.");
    }

    AutoUnlock unlock(auto_lock);

    // execute
    if ((false == request_controller_->IsLowVoltage()) &&
        request_ptr->CheckPermissions() && init_res) {
      LOG4CXX_DEBUG(logger_, "Execute MobileRequest corr_id = "
                    t_info_ptr->requestId()
                    timeout: " << timeout_in_mseconds);
      request_ptr->Run();
    }
  }
}
```

request_ptr->Run()调用 RPC 内部处理函数

4 SetDisplayLayoutRequest

4.1 通过 SendHMIRequest 转发

```
void SetDisplayLayoutRequest::Run() {
  LOG4CXX_AUTO_TRACE(logger_);
  ApplicationConstSharedPtr app =
      ApplicationManagerImpl::instance()->application(connection_key());

  if (!app) {
    LOG4CXX_ERROR(logger_, "Application is not registered");
    SendResponse(false, mobile_apis::Result::APPLICATION_NOT_REGISTERED);
    return;
  }

  (*message_)[strings::msg_params][strings::app_id] = app->app_id();
  SendHMIRequest(hmi_apis::FunctionID::UI_SetDisplayLayout,
                 &((*message_)[strings::msg_params]), true);

}
```

4.2 SendHMIRequest

```
uint32_t CommandRequestImpl::SendHMIRequest(
    const hmi_apis::FunctionID::eType& function_id,
    const smart_objects::SmartObject* msg_params,
    bool use_events) {
  smart_objects::SmartObjectSPtr result = new smart_objects::SmartObject;

  const uint32_t hmi_correlation_id =
      ApplicationManagerImpl::instance()->GetNextHMICorrelationID();
  if (use_events) {
    LOG4CXX_DEBUG(logger_,
                  "subscribe_on_event " << function_id << " "
                                        << hmi_correlation_id);
    subscribe_on_event(function_id, hmi_correlation_id);
  }

  smart_objects::SmartObject& request = *result;
  request[strings::params][strings::message_type] = MessageType::kRequest;
  request[strings::params][strings::function_id] = function_id;
  request[strings::params][strings::correlation_id] = hmi_correlation_id;
  request[strings::params][strings::protocol_version] =
      CommandImpl::protocol_version_;
  request[strings::params][strings::protocol_type] =
      CommandImpl::hmi_protocol_type_;

  if (msg_params) {
    request[strings::msg_params] = *msg_params;
  }

  if (!ApplicationManagerImpl::instance()->ManageHMICommand(result)) {
    LOG4CXX_ERROR(logger_, "Unable to send request");
    SendResponse(false, mobile_apis::Result::OUT_OF_MEMORY);
  }
  return hmi_correlation_id;
}
```

4.3 ManageHMICommand

```
bool ApplicationManagerImpl::ManageHMICommand(
    const commands::MessageSharedPtr message) {
  LOG4CXX_AUTO_TRACE(logger_);

  if (!message) {
    LOG4CXX_WARN(logger_, "Null-pointer message received.");
    return false;
  }

  if (IsLowVoltage()) {
    LOG4CXX_WARN(logger_, "Low Voltage is active");
    return false;
  }

  MessageHelper::PrintSmartObje

  CommandSharedPtr command = HMICommandFactory::CreateCommand(message);
  if (!command) {
    LOG4CXX_WARN(logger_, "Failed to create command from smart object");
    return false;
  }

  int32_t message_type =
      (*(message.get()))[strings::params][strings::message_type].asInt();

  // Init before adding to request controller to be able to set request timeout
  if (command->Init()) {
    if (kRequest == message_type) {
      LOG4CXX_DEBUG(logger_, "ManageHMICommand");
      request_ctrl_.addHMIRequest(command);
    }

    command->Run();
    if (kResponse == message_type) {
      const uint32_t correlation_id =
          (*(message.get()))[strings::params][strings::correlation_id].asUInt();
      request_ctrl_.OnHMIResponse(correlation_id);
    }
    return true;
  }
  return false;
}
```

HMICommandFactory::CreateCommand工厂模式根据RPC定义的ID创建对应RPC消息处理对象

此处command 为UiSetDisplayLayoutRequest类型

command->Run进行内部处理

4.4 UiSetDisplayLayoutRequest::Run

```
void UiSetDisplayLayoutRequest::Run() {
  LOG4CXX_AUTO_TRACE(logger_);
  SendRequest();
}
```

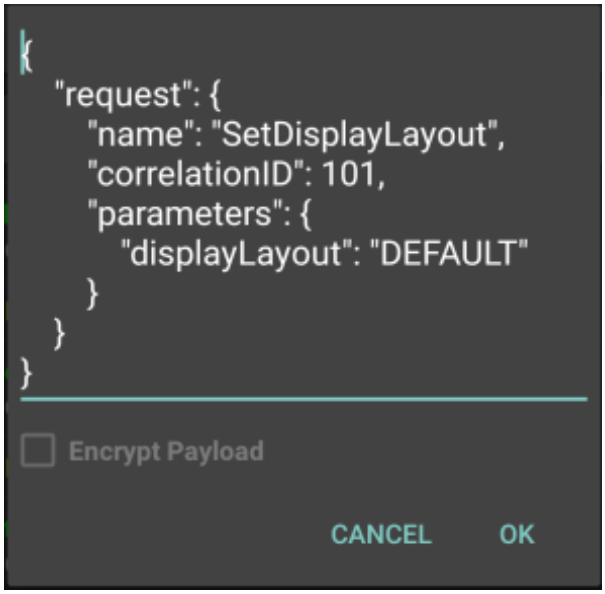
4.5 监视数据

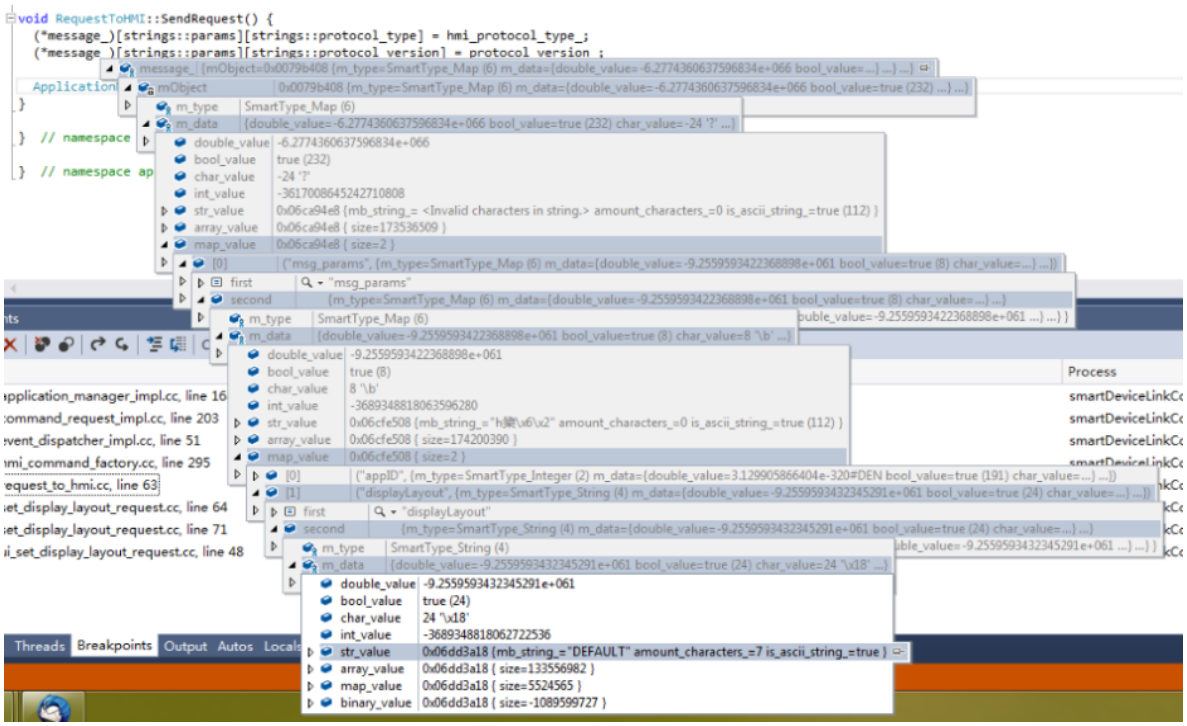
```
void RequestToHMI::SendRequest() {
  (*message_)[strings::params][strings::protocol_type] = hmi_protocol_type_;
  (*message_)[strings::params][strings::protocol_version] = protocol_version_;

  ApplicationManagerImpl::instance()->SendMessageToHMI(message_);
}
```

监视上图 message 的内容，详情见第 5 节。

5 setDisplayLayout 不同参数数据监视

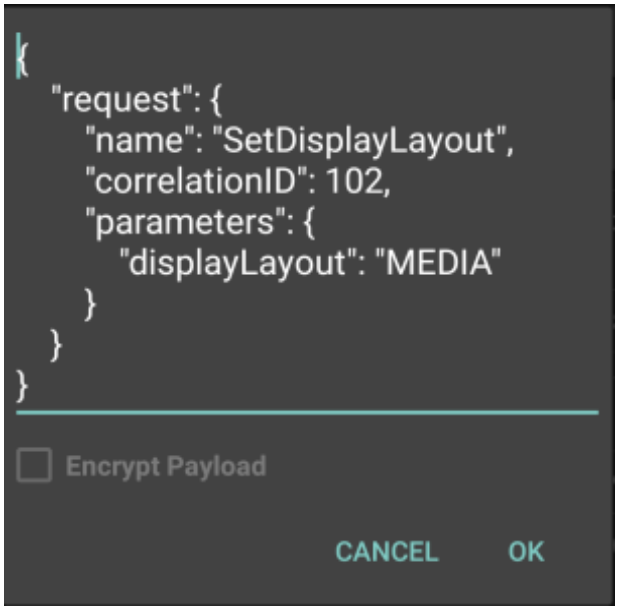
5.1 参数为 DEFAULT

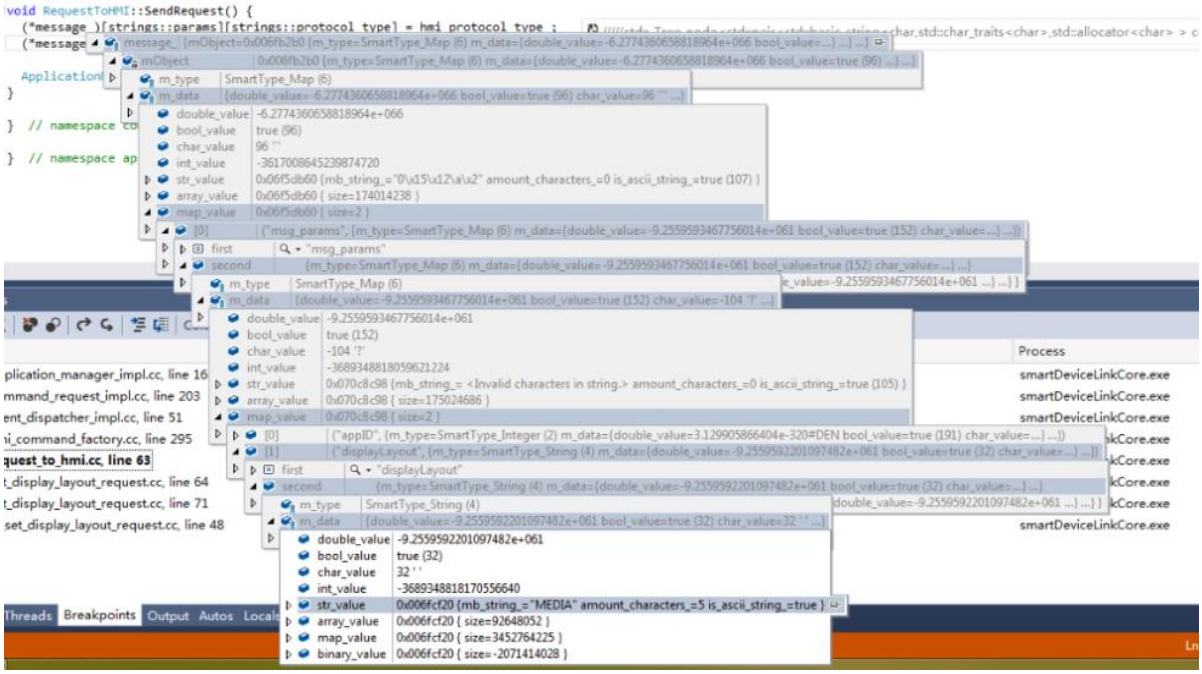




重点关注 mb_string_ = “DEFAULT”。

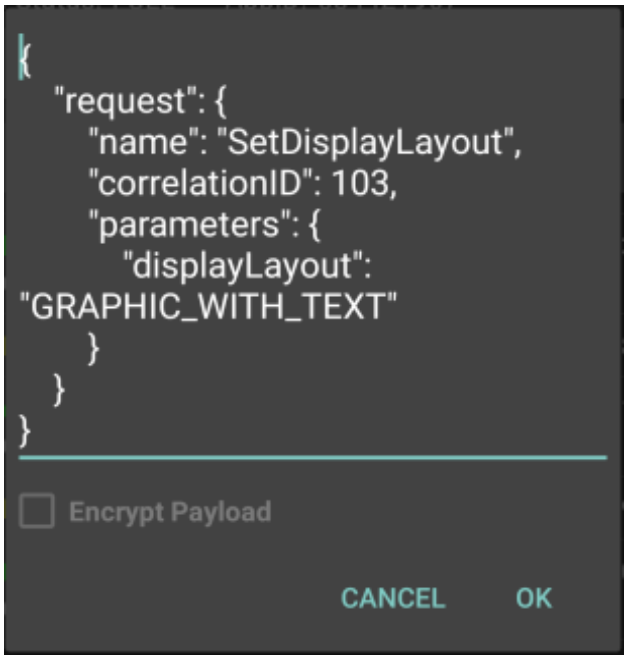
5.2 参数为 MEDIA

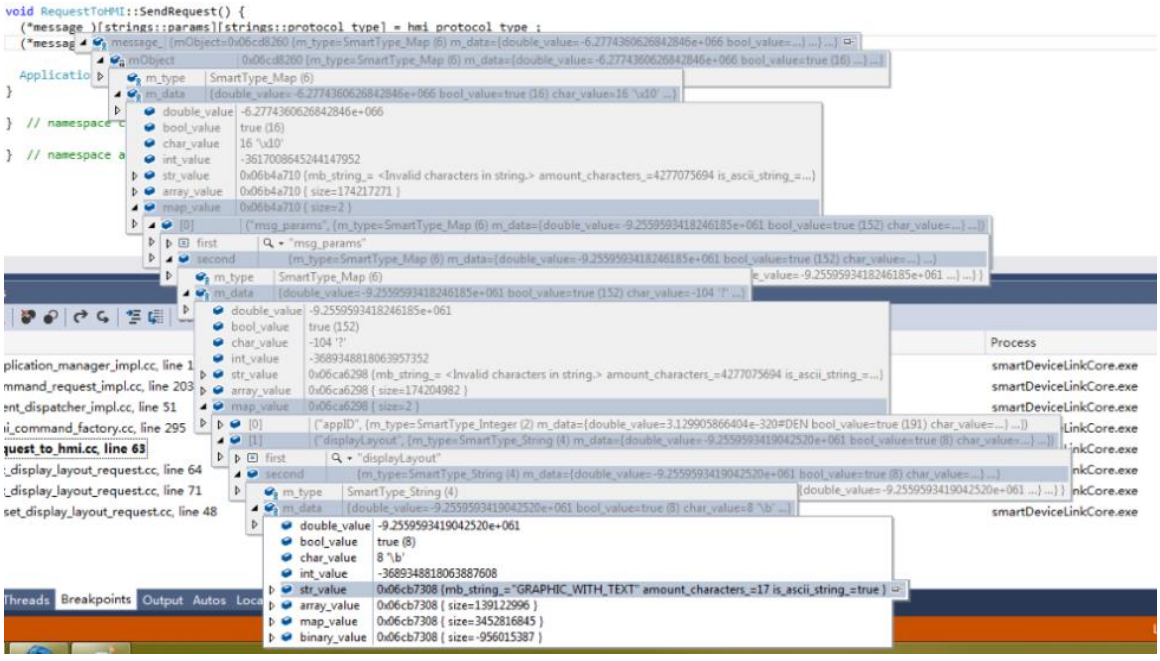




重点关注 mb_string_ = “MEDIA”。

5.3 参数为 GRAPHIC_WITH_TEXT





重点关注 mb_string_ = “GRAPHIC_WITH_TEXT”。

选择其他参数，发送给 HMI 的数据也类似

6 结论

通过流程分析，发现 setDisplayLayout 的 RPC 在 SDL 中并无特殊处理，而且选择不同的参数，发送给 HMI 侧的数据都与之匹配。

因此，setDisplayLayout 在 HMI 表现出来的问题与 SDL 内部无关。