# Project: Annual Handoff flow process at BlackChip Semiconductors (BCS)

## Company Background:

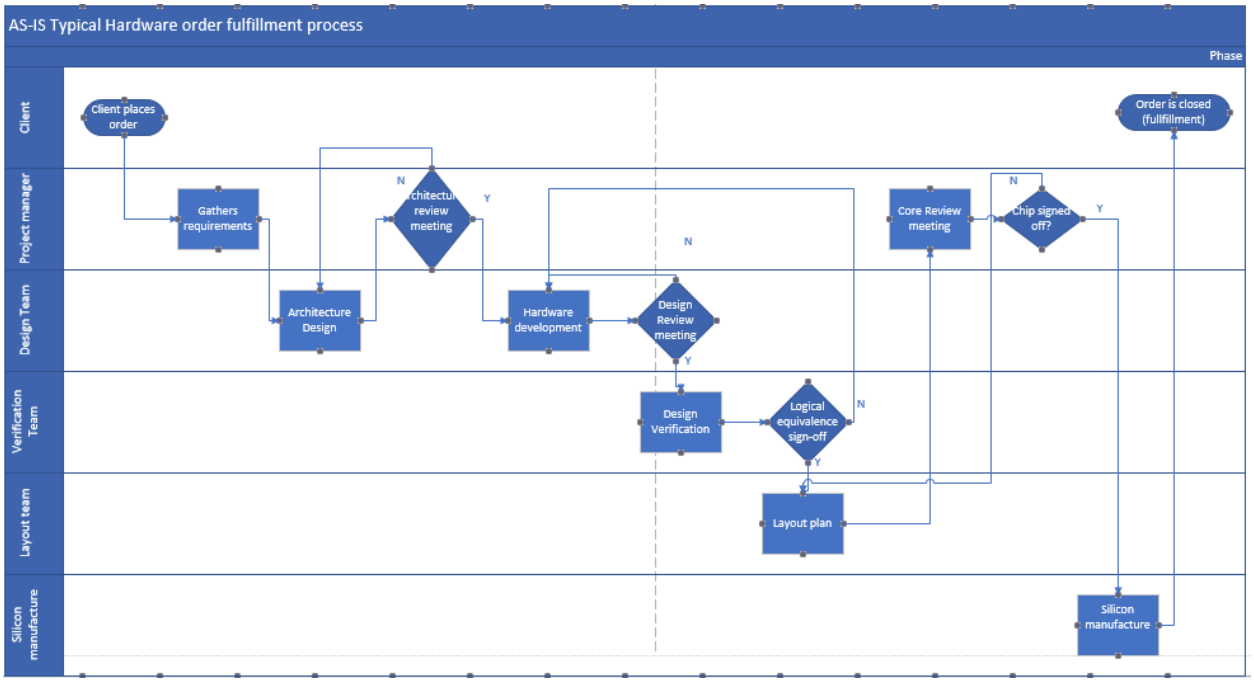
Blackchip is an upcoming semiconductor start-up specialized in developing low-cost hardware solutions for clients that are involved in Non-Profit activities. A typical project at BlackChip semiconductor starts with client placing a order and goes through several stages like sales, management, design, verification, layout planning, silicon manufacturing.

## Process and Actors:

Once the client places an order, the sales inventory gets updated and a program manager gathers requirements to communicate to the designated Design Team. There are frequent architecture review meetings that are held until architecture is finalized. Once the architecture is finalized then the sales team performs projected cost benefit analysis and parallely Design development begins. For each design cycle, the verification team works on finding bugs within the design. If any breaks are found, then design is handed off to the design team to fix the issues. Once sign-off is clean, the layout engineer places the entire design on layout (A 3D platform) to simulate the actual chip before manufacturing. Once the layout process is finished, A core review meeting is held to take care of any last-minute hiccups before proceeding to silicon manufacturing.Once silicon manufacturing completes, the sales team performs actual cost benefit analysis and the order is fulfilled to the customer.

- Client - Each client places orders based on their requirements. They can make multiple orders.
- Sales - They handle the inventory updates. They also work on Actual and Projected cost benefit analysis, profit or loss estimation during the entire project life cycle.
- Project manager (Management) - They receive the order and deliver the requirements to the appropriate design teams. They also conduct the review meetings across the teams.They are also part of signing-off of the project before delivering the order to silicon manufacturer
- Design & verification Team - They design the chips, involve in hardware development and after the designing, they conduct various verifications on those chips.
- Layout team - They perform chip planning on the designed and verified chips based.
- Silicon manufacture - Post Layouting, silicon manufacturer manufactures the chips based on the order count.

## Swimlane Diagram: AS-IS:




**Issues with Current Process:**

The current process has some minor issues.

1) The communication between the Design and Verification team. There is no necessity of frequent design meetings if the verification stage is failed. For example, if a chip “A” has met all goals of power, performance and area and signed off by the design team and if the verification team found bugs then entire design resources are wasted.So, it’s not ideal for the verification team to wait until design review meetings take place. It’s best to have a strategy.
2) Once the layout planning is done, there are no meetings happening internally within the team. These meetings are necessary for any team before the final core review meeting to make sure that everything is perfect.

**Solution:**

BCS has come up with the solutions for those two problems.

→ For the first problem, combining the design and verification teams will resolve the dependencies among the two teams. Because they are interrelated, it’s best practice to put them under the same actor.

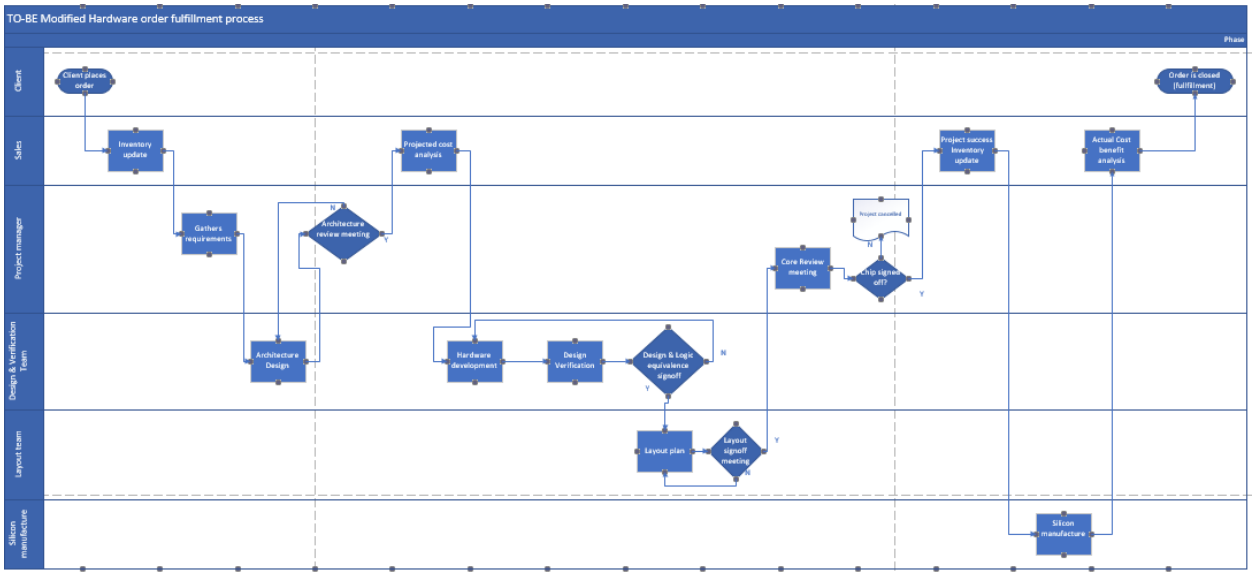
→ As far as the second problem is concerned, BCS planned to add a layout signoff meeting before the final core-review meeting. This might add some delay in the process, but it’s necessary to have this meeting, because this makes the process more efficient before handing chips to the client.

**Enablers:**

The changes suggested above contribute to modifying Workflow Design and Information systems.

- [**Workflow Design**] Added sales as a new actor and additional process restructuring in Layout, Design and Verification for making the process more streamlined.
- [**Information systems**] Addition of actor “Sales" would create additional data which can be used to cost benefit analysis..

**Swimlane Diagram: TO-BE:**

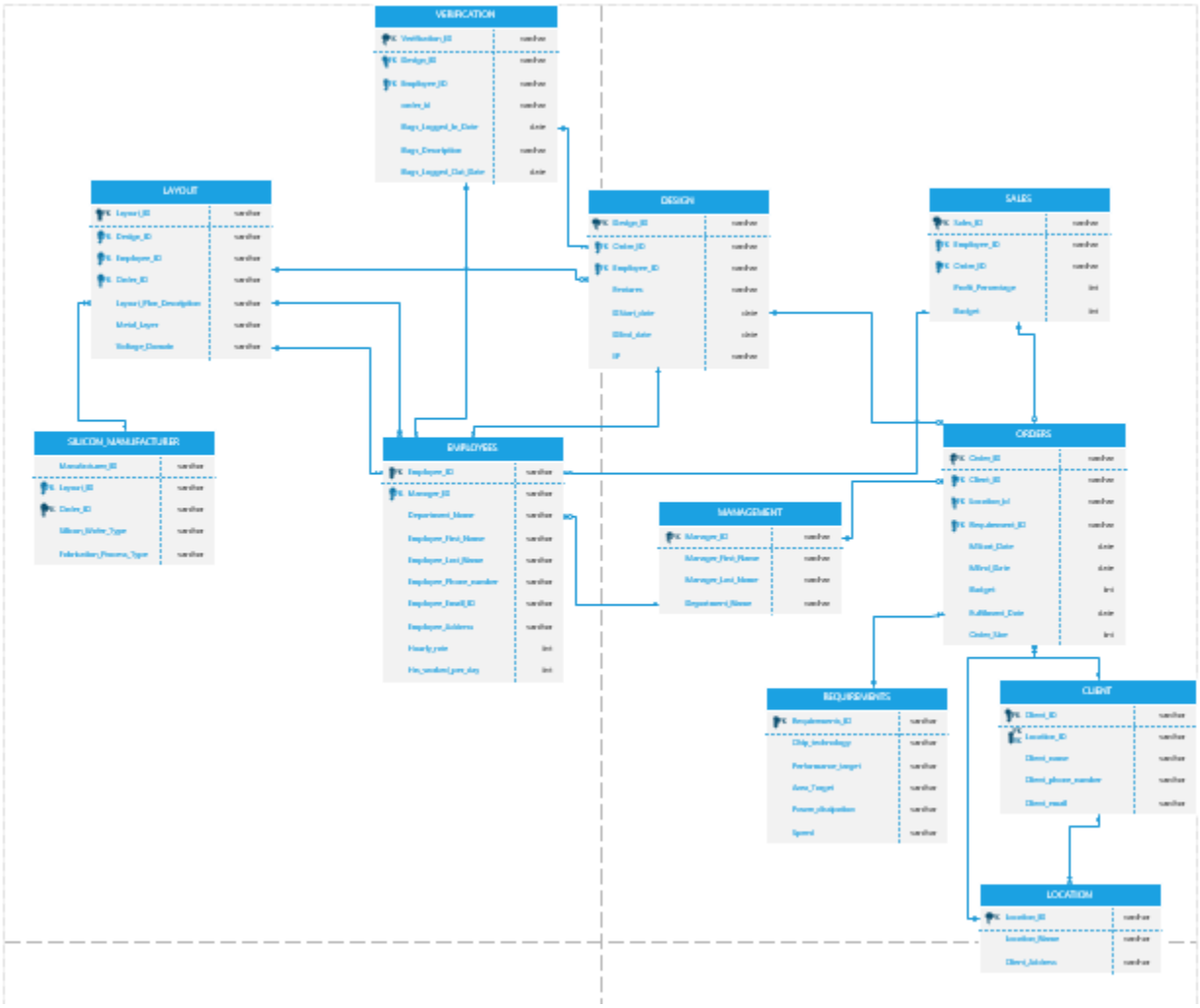



**Detailed Description of the Business Rules and User Requirements:**

- One order is placed by one and only one client, one client  can place on or more orders.
- One client will be associated with one or more locations. Each location is associated with one client.
- One order will have one and only one requirement. Requirements will be for one or more orders.
- One order will be assigned to one and only one manager, Each manager may or maynot handle an order.
- One order will be assigned to one sales team, each sales team may or maynot handle an order.
- Each order will be assigned to one and only one design team, design teams will work on zero or more orders.
- Each Design will be verified only once, verification is done on one or more designs.

- Each verified design will have one and only layout, multiple designs can have many layouts.
- Each layout-design is manufactured by one silicon manufacturer. Each silicon manufacturer can  manufacture many layout-designs.
- Each team like sales, management, design, verification ,layout have one or more employees. Each employee belongs to one and only one department team.

**ERD Diagram:**




**Entity Description:**

1. **Client:** Each client places an order. Each client is established in 1 or more locations. This entity contains the client's id, name, phone number, email id and location's id. Here client_id and location_id are the composite primary key. Location_Id is the foreigh key.
2. **Locations:** The entity locations have unique locations in which clients are present. This entity contains Location's ID, name and address. Here Location_id is the primary key.
3. **Orders:** This entity gives information about the orders placed such as the id of the client who placed the order, the client's location, the requirement's id through which we can get the requirements of the order, order start date, order end date, order fulfillment date, order size and the budget assigned to this order.
4. **Requirements:** This entity gives information about the requirements such as the chip technology to be used, target performance, target area, power dissipation and speed.
5. **Employees:** This entity contains information of all employees such as their first name ,last name, phone number, email id, address, hourly rate, number of hours worked per day, department they belong to, and their manager' id.
6. **Management:** This entity contains the id, first name, last name and department of the manager.
7. **Design:** This entity gives design features, design start date , design end date, it's ip status for each order placed by the client.
8. **Verification:** This entity gives description of the bugs detected along with the bugs log-in and log_out date for each design.
9. **Layout:** This entity contains information about the layout's plan, metal layer and voltage domain for each design.
10. **Silicon manufacturer:** This entity describes the materials and methodology type used for the manufacturing of chips
11. **Sales:** This entity contains the budget and its respective profit percentage for each order along with the sales employees working for each order.

**Data dictionary:**

| Database | Attribute | Data type | Field size | Key type | Accepts null value | Description |
|---|---|---|---|---|---|---|
| Clients | Client ID | VARCHAR | 10 | Primary key | N | Unique IDs for all the clients |
| | Location ID | VARCHAR | 10 | Primary key, Foreign Key | N | Unique IDs for all the locations |
| | Client Name | VARCHAR | 30 | | Y | Full name of client |
| | Client phone number | VARCHAR | 40 | | Y | Phone number of client |
| | Client email | VARCHAR | 50 | | Y | Email of client |
| | | | | | | |
| Locations | Location ID | VARCHAR | 10 | Primary key | N | Unique IDs for all locations |
| | Location Name | VARCHAR | 30 | | Y | Locations where client is established |
| | Client Address | VARCHAR | 255 | | Y | Location address where client is established |
| | | | | | | |
| Orders | Order ID | VARCHAR | 10 | Primary key | N | Unique IDs for all the orders |
| | Client ID | VARCHAR | 10 | Foreign key | Y | Unique IDs for all the clients |
| | Location ID | VARCHAR | 10 | Foreign key | Y | Unique IDs for all the clients |
| | Requirement ID | VARCHAR | 10 | Foreign key | Y | Unique IDs for all requirements imposed by customers |
| | MStart date | DATE | | | N | Start date of the project |
| | MEnd date | DATE | | | N | End date of the project |
| | Budget | integer | 20 | | N | Budget for the chip |
| | Fullfillment date | DATE | | | N | Due date for the chip completion |
| | Order size | integer | 10 | | N | Number of chips required |
| | | | | | | |
| Requirements | Requirements ID | VARCHAR | 10 | Primary key | N | Unique IDs for all requirements imposed by customers |
| | Chip technology | VARCHAR | 15 | | Y | Chip technology is a number that specifies size of technology typically in nano meter |
| | Performance target | VARCHAR | 10 | | Y | Performance target is set per 100% to convey efficiency |
| | Area target | VARCHAR | 10 | | Y | Area target is a number in nn/mm size of chip |
| | Power dissipation | VARCHAR | 10 | | Y | Power dissipation is an integer typically in milli watts |
| | Speed | VARCHAR | 10 | | Y | Describes the performance rate of the chip typically in GHz/ns |
| | | | | | | |
| Employees | Employee ID | VARCHAR | 10 | Primary key | N | Unique ID to identify all members of company |
| | Manager_ID | VARCHAR | 30 | Foreign key | Y | Unique ID to identify all members of company |
| | Department name | varChar | 30 | | Y | department ID to know which team he belongs |
| | Employee first name | varChar | 30 | | N | Name of employee |
| | Employee Last name | varChar | 50 | | N | Last name of employee |
| | Employee phone number | varChar | 40 | | N | Phone number of employee |
| | Employee email ID | varChar | 255 | | N | Email ID of employee |
| | Employee Address | varChar | 255 | | Y | Address of employee |
| | Hourly rate | Integer | 10 | | N | Hourly rate of the employee |
| | HRS_WORKED_PER_DAY | INTEGER | 10 | | N | |
| | | | | | | |
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| | | | | | | |
| Management | Manager_ID | VARCHAR | 10 | Primary key | N | Unique ID for a manager |
| | Manager first name | VARCHAR | 40 | | Y | first name of employee |
| | Manager last name | VARCHAR | 40 | | Y | Last name of employee |
| | Department name | VARCHAR | 40 | | N | department name |
| | | | | | | |
| | | | | | | |
| Design | Design_ID | varChar | 10 | Primary key | N | Unqiue ID for a design |
| | Order ID | varChar | 10 | Foreign Key | Y | Unique ID for orders |
| | Employee ID | varChar | 10 | Foreign Key | Y | Unique ID for a employee working on design |
| | Features | varChar | 255 | | Y | Description of design features |
| | DStart date | DATE | | | N | Start date of design |
| | DEnd date | DATE | | | N | End date of design |
| | IP | varChar | 15 | | Y | IP status of the design |
| | | | | | | |
| Verification | Verification_ID | VARCHAR | 10 | Primary key | N | Unique ID for a verification |
| | Employee ID | VARCHAR | 10 | Foreign Key | Y | Unique ID for an employee working on verification |
| | ORDER_ID | VARCHAR | 10 | Foreign Key | Y | Unique IDs for all the orders |
| | Design_ID | VARCHAR | 10 | Foreign Key | Y | Unique IDs for the designs |
| | Bugs logged-in-date | DATE | 15 | | N | Register to track the bugs that are found in design |
| | Bugs description | varChar | 255 | | Y | Description of bugs that are identified |
| | Bugs logged-out-date | DATE | 15 | | N | Register to track closing dates of bugs that are found in design |
| | | | | | | |
| Layout | Layout_ID | VARCHAR | 10 | Primary key | N | Unique IDs for the layouts |
| | Employee ID | VARCHAR | 10 | Foreign Key | Y | Unique ID of employees working on identifying bugs |
| | ORDER_ID | VARCHAR | 10 | Foreign Key | Y | Unique IDs for all the orders |
| | Design ID | VARCHAR | 10 | Foreign Key | Y | Unique ID for layout team to track the design they are layouting |
| | Layout plan description | VARCHAR | 255 | | N | Description of chip planning like shape of chip etc. |
| | Metal layer | VARCHAR | 5 | | Y | Metal layer describes type of mental used in chip layout simulation |
| | Voltage domain | VARCHAR | 5 | | Y | Domain simulates type of power domain used for layour simulation |
| | | | | | | |
| Silicon manufacturer | Manufacturer ID | varChar | 10 | | N | |
| | Layout ID | varChar | 10 | Foreign Key | Y | Unique ID for a layout |
| | Order ID | varChar | 10 | Primary key | N | Unique ID for an order |
| | Silicon wafer type | varChar | 255 | | Y | Description of the material type used for silicon manufacturing process |
| | Fabrication process type | varChar | 255 | | Y | Description of methodology type |
| | | | | | | |
| Sales | Sales ID | varChar | 10 | Primary Key | N | Unique IDs for the sales |
| | Employee ID | varChar | 10 | Foreign Key | Y | Unique IDs for all the employees |
| | Order ID | varChar | 10 | Foreign Key | Y | Unique IDs for all the orders |
| | Profit_percentage | Integer | 20 | | N | Profit Percentage for an order |
| | Budget | Integer | 10 | | N | Expected Budget for all the orders |