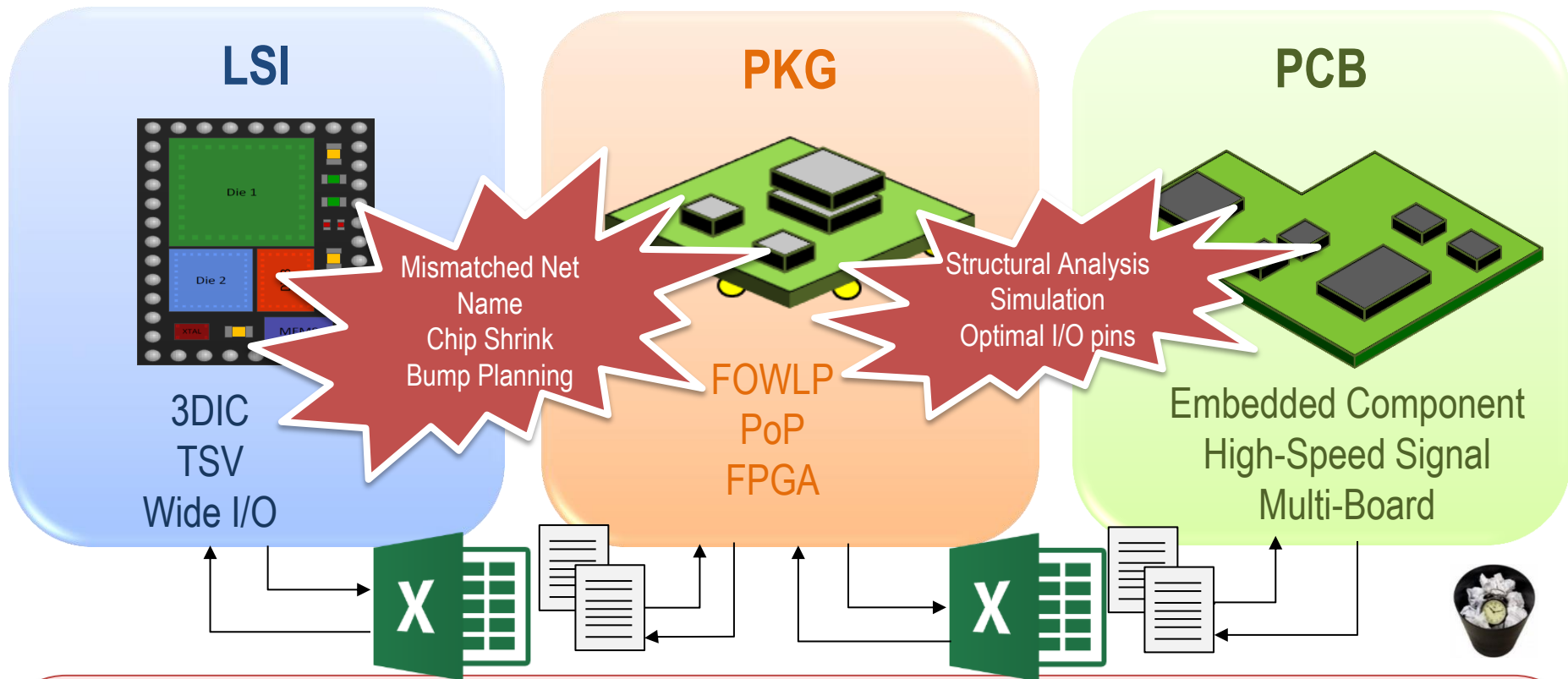


IEEE 2401-2019 Publication with Supporting IBIS Version 7.0

JEITA SD-TC Kazunari Koga (Zuken)
2020.1.31

DesignCon IBIS Summit
Santa Clara, California

LSI/PKG/PCB Co-design Challenges

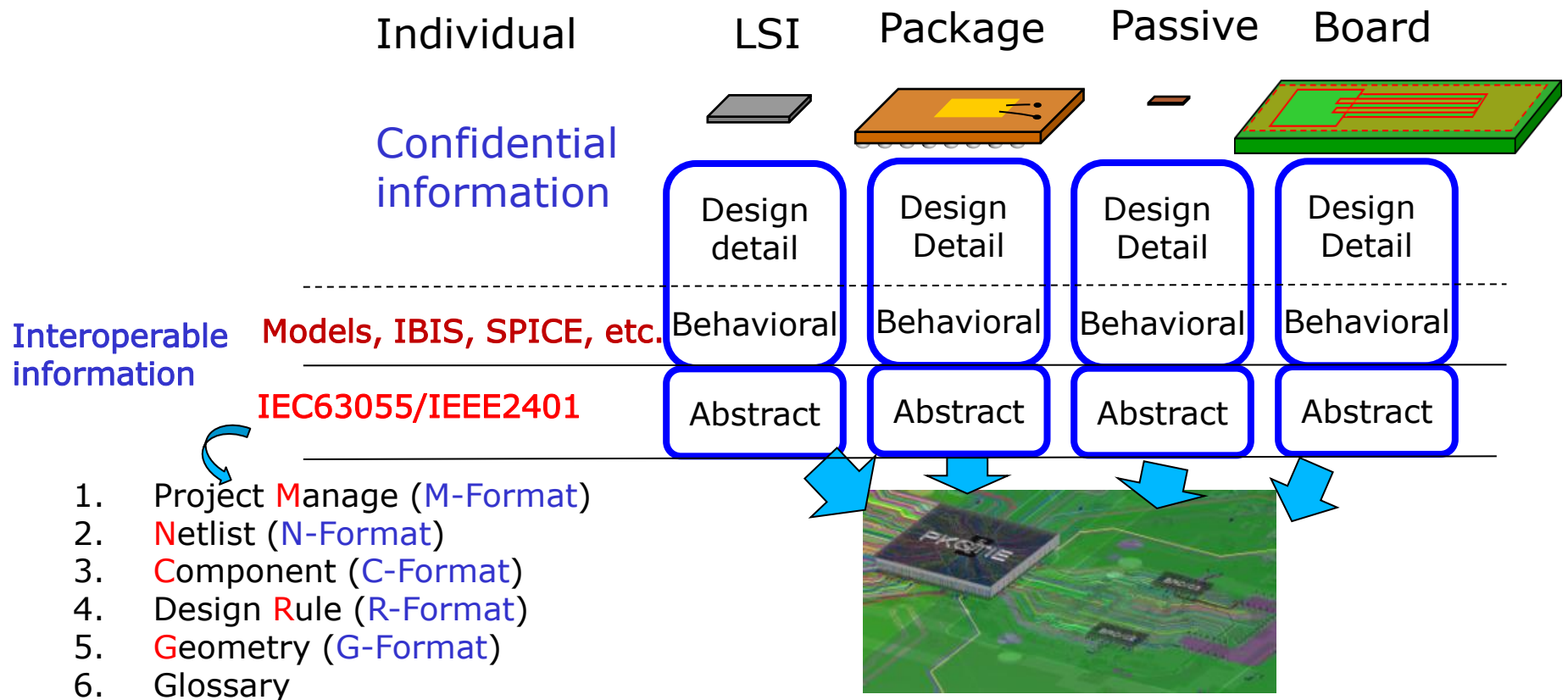


- Spreadsheet management → Human errors occurring frequently
- Various interfaces → Difficulty in unifying design flows
- Diverse design cultures → An impediment to sharing constraints, leading to increasing iteration

What is LPB Format?

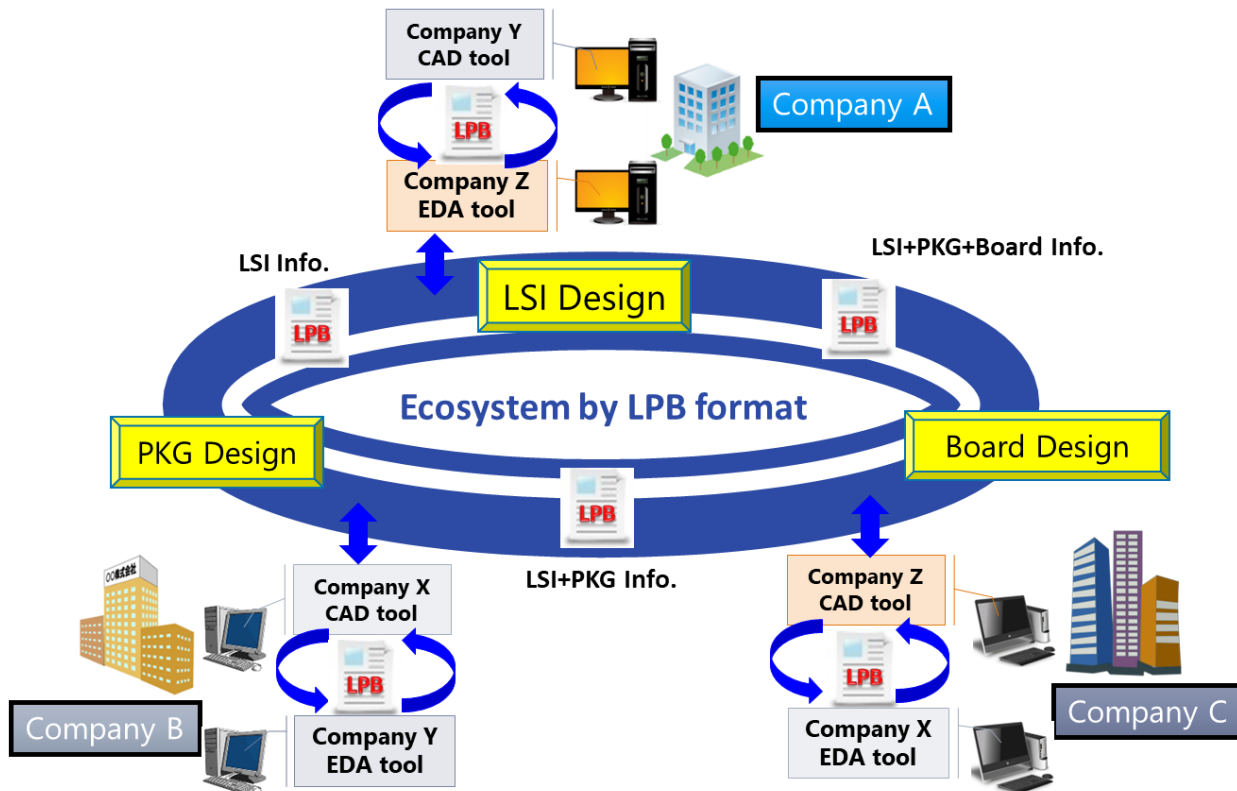
Standard format for **L**SI **P**ackage **B**oard (LPB) 
interoperable design.

For effective information exchange in supply chain.

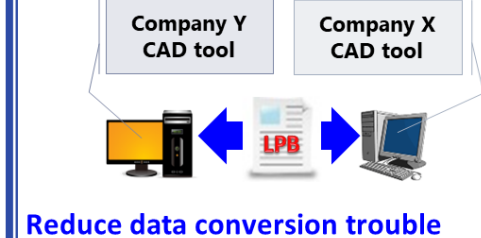


What is the merit for user

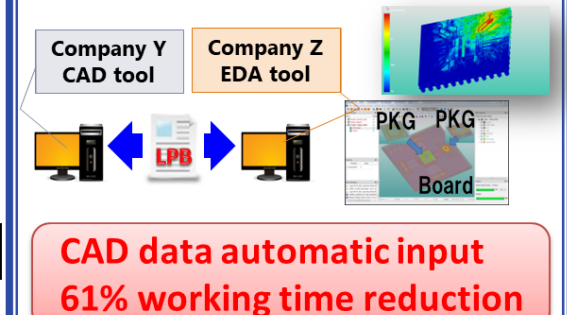
IEEE2401 user can reduce overall design time.



CAD-CAD cooperation

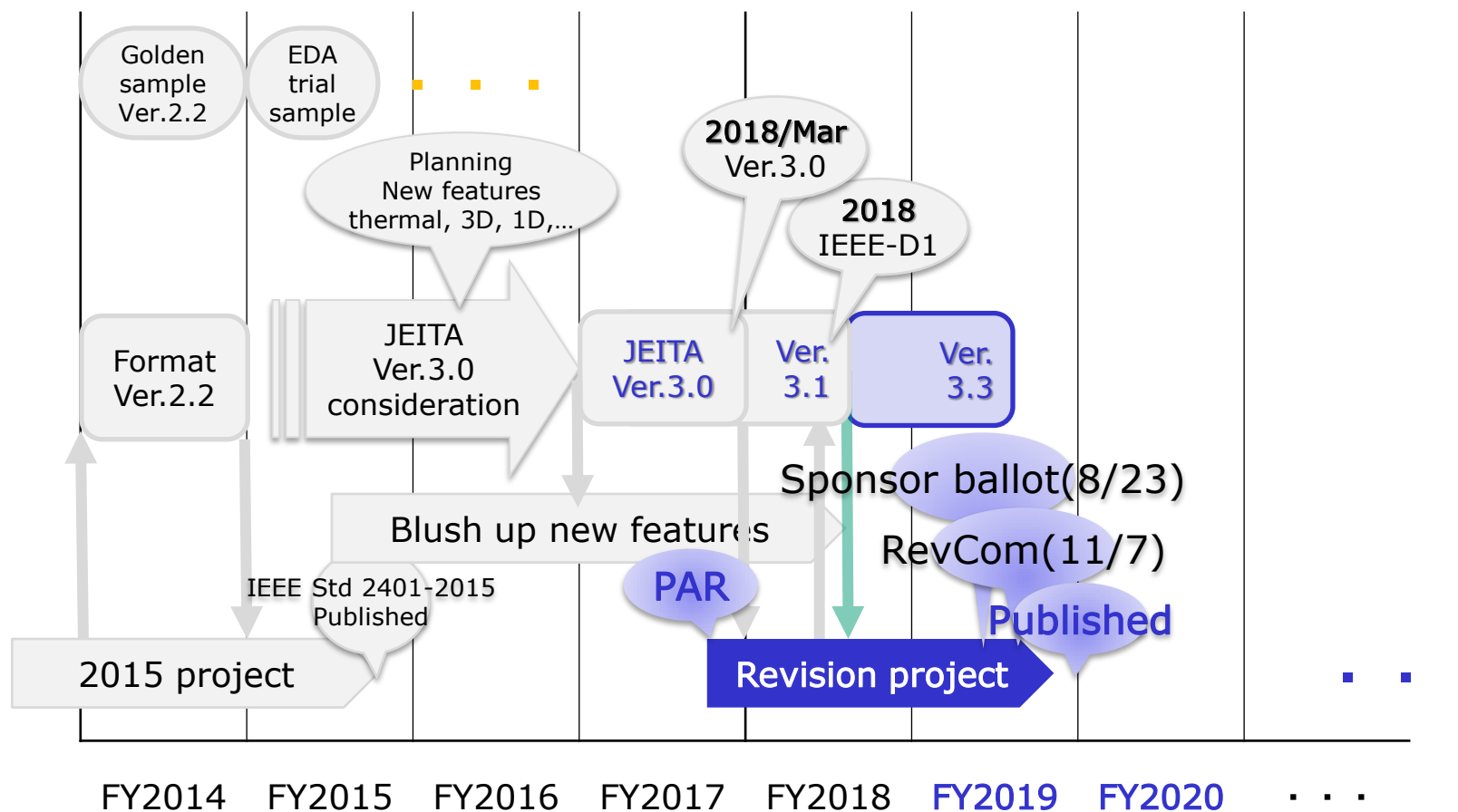


CAD-EDA cooperation



Revision with enhancement of IEEE 2401-2015

■ IEEE-2401-2019 is published



Highlights in IEEE2401-2019 enhancement

Additional support of several models

8.2.12.5.1 Electrical model (**IBIS Version 7.0**, S-para touchstone)

The `<affine_transformation>` element defines an Affine Spatial Transformation Matrix to transform the coordinate system of objects placed on the lower hierarchy of the specified object to the coordinate system of objects placed on the higher hierarchy in C-Format file.

Thermal model (Delphy, 2Resistor, JTAM)

3D structure (STEP, SAT, IGES)

```
<affine_transformation>
  a12="real_number"
  a13="real_number"
  a14="real_number"
  a21="real_number"
  a22="real_number"
  a23="real_number"
  a24="real_number"
  a31="real_number"
  a32="real_number"
  a33="real_number"
  a34="real_number"
  [<step:ref_product> element |
   <sat:ref_body> element]...
  [<extensions> element]...
</affine_transformation>
```

P&R guidelines (Constraints)

Function to organize data files and history

8.2.12.5.2 Attribute definitions

From a_{11} to a_{34} are matrix element of Affine Spatial Transformation Matrix as follows.

$$M = \begin{bmatrix} a_{11} & a_{12} & a_{13} & a_{14} \\ a_{21} & a_{22} & a_{23} & a_{24} \\ a_{31} & a_{32} & a_{33} & a_{34} \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

The transformation of the coordination system in referenced file (x, y, z) to the coordination system in C-Format (x', y', z') is thus defined as:

$$\begin{bmatrix} x' \\ y' \\ z' \end{bmatrix} = M \begin{bmatrix} x \\ y \\ z \end{bmatrix}$$

8.2.12.5.3 Element contents

The `<affine_transformation>` element contains the following elements. The `<step:ref_product>` and `<sat:ref_body>` elements define the objects in the referenced file that are transformed by Affine Spatial Transformation Matrix. If any objects are not defined, all objects in that files are transformed.

```
<step:ref_product>
<sat:ref_body>
<extensions>
```

8.2.12.5.4 The `<step:ref_product>` element

8.2.12.5.4.1 General

The `<step:ref_product>` element specifies a STEP file whose coordinate systems are transformed by affine transformation. The coordinate system of objects placed on the lower hierarchy of the specified object are also transformed by the same affine transformation matrix. Normally, this attribute specifies the top level object of the referenced STEP file. If the object is not specified, all objects in STEP file are transformed by same Affine Spatial Transformation Matrix.

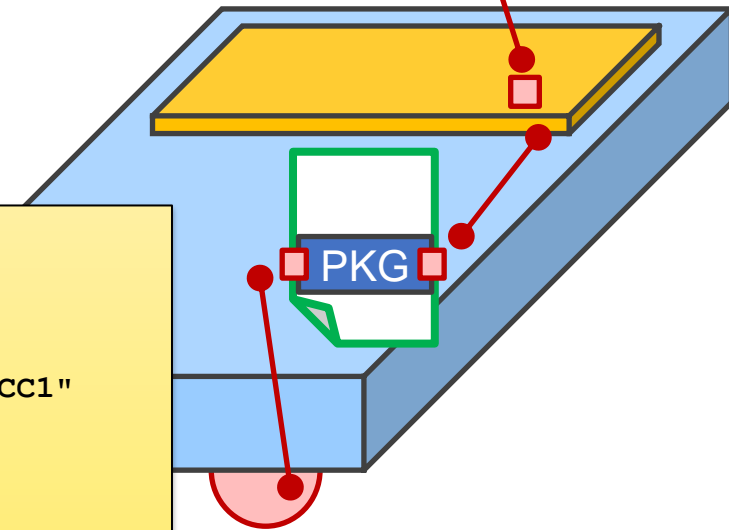
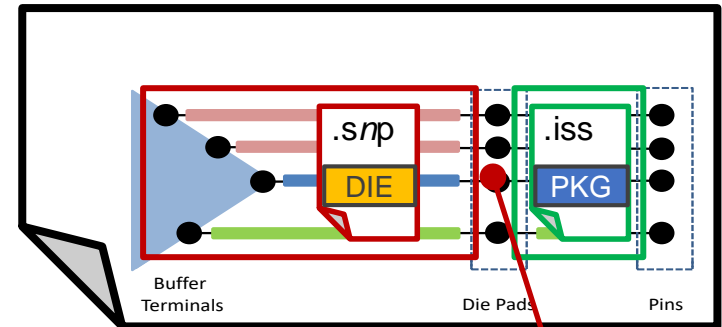
```
<step:ref_product
  name="object name in STEP file"
>
  [<extensions> element]...
</step:ref_product>
```

IEEE2401-2019 linking with IBIS Version 7.0

[Interconnect Model] can define die pad.

IEEE2401-2019 supports directly referencing the die pad on IBIS like [Interconnect Model], and to add Touchstone and IBIS-ISS as referring models.

Therefore, DIE and PKG module can be available separately without **double counting problem**.



```
<reference xmlns:ibis="http://www.jeita.or.jp/LPB/ibis"
  reffile="XXXX.ibs" format="IBIS"
>
  <connection socket_name="socket1" port_id="A1">
    <ibis:ref_port component="ibis_die" signal_name="VCC1"
      terminal_type="Pad_Rail" />
  </connection>
  <connection socket_name="socket1" port_id="A2">
    <ibis:ref_port component="ibis_die" pin_name="3"
      terminal_type="Pad_I/O" />
  </connection>
  ...
</reference>
```



Feedback from early adopter

Several parts vendors start adopting the format to provide their product specification library. Their suggestions follow below.

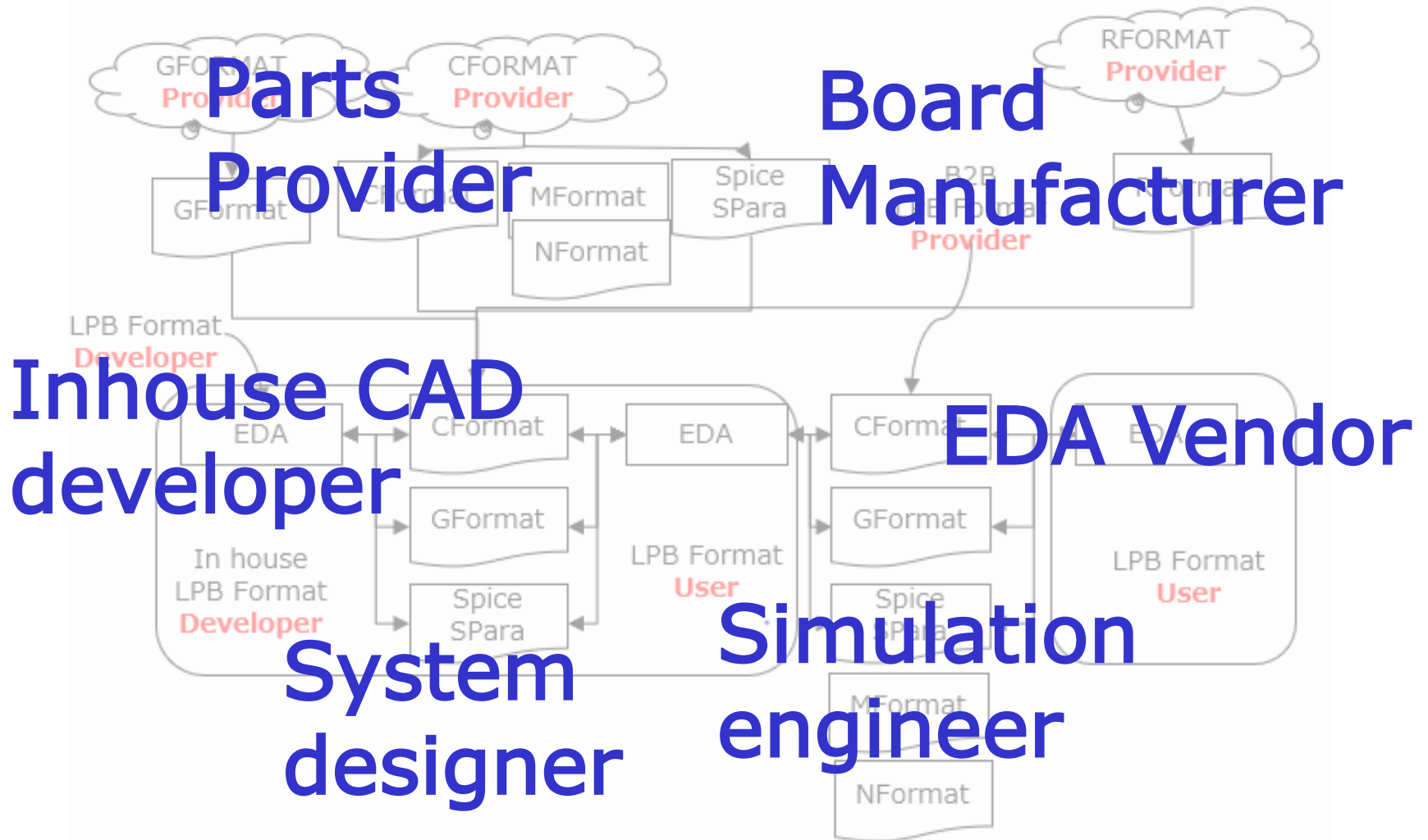
“It would be nice to have a textbook with a specific scope for user purpose.”

- Which part of the format shall I use to express passive component data for simulation?
 - Physical shape, electrical models, how to combine them, ...
- I created data. I want to check if it is made correctly.
 - What's the point? Are there any tools to check?
- . . .

EDUCATON COURSE PLANNING FOR IEEE2401

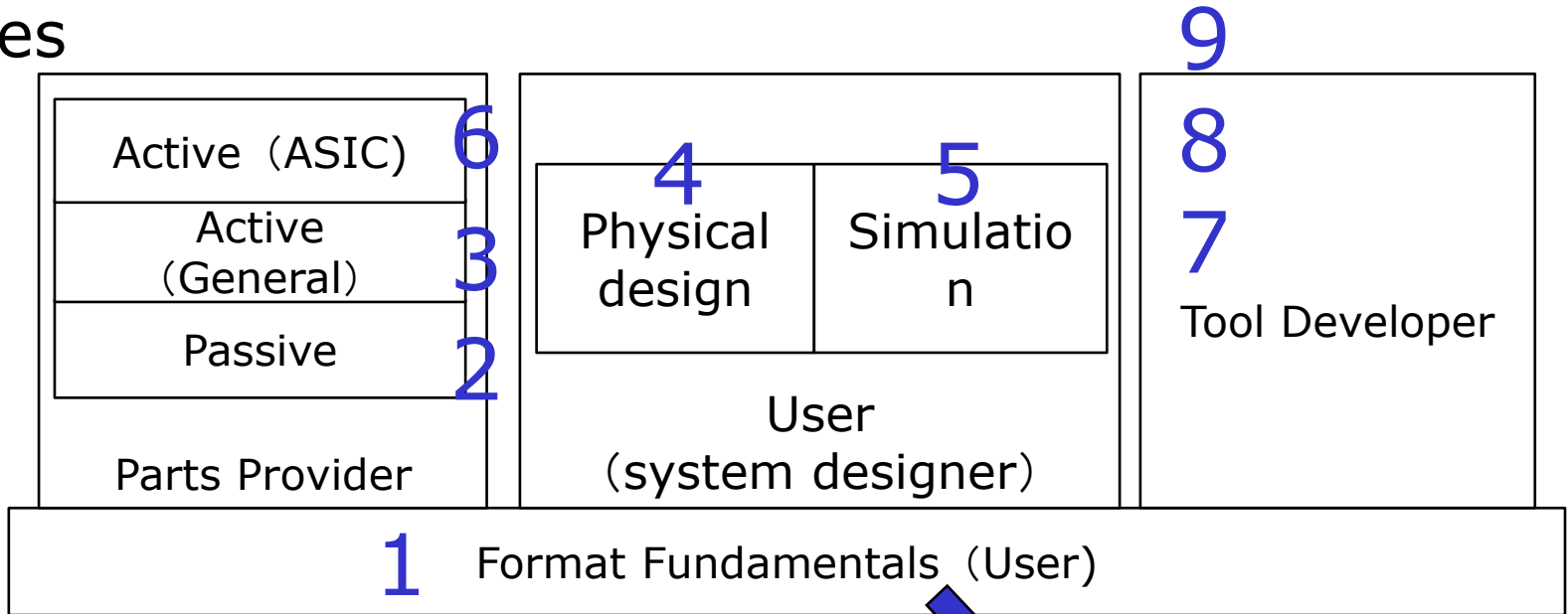
to accelerate format utilization among players

LPB Format Users



Educational course

Experties



Nine courses are planned.

<http://jeita-sdtdc.com/en/committee-activity/lpbinterface-wg/jeita-lpb-stdformat/>

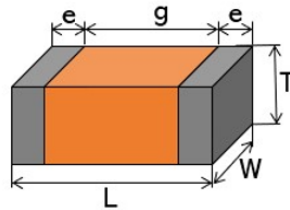
Every course includes

- Fundamentals of IEEE2401 Format
- Training session

Sample of textbook

2.1 Capacitor

In this section, we will look at the simplest C-Format using Murata's chip capacitor (GRM21BB30J226ME38) as an example.

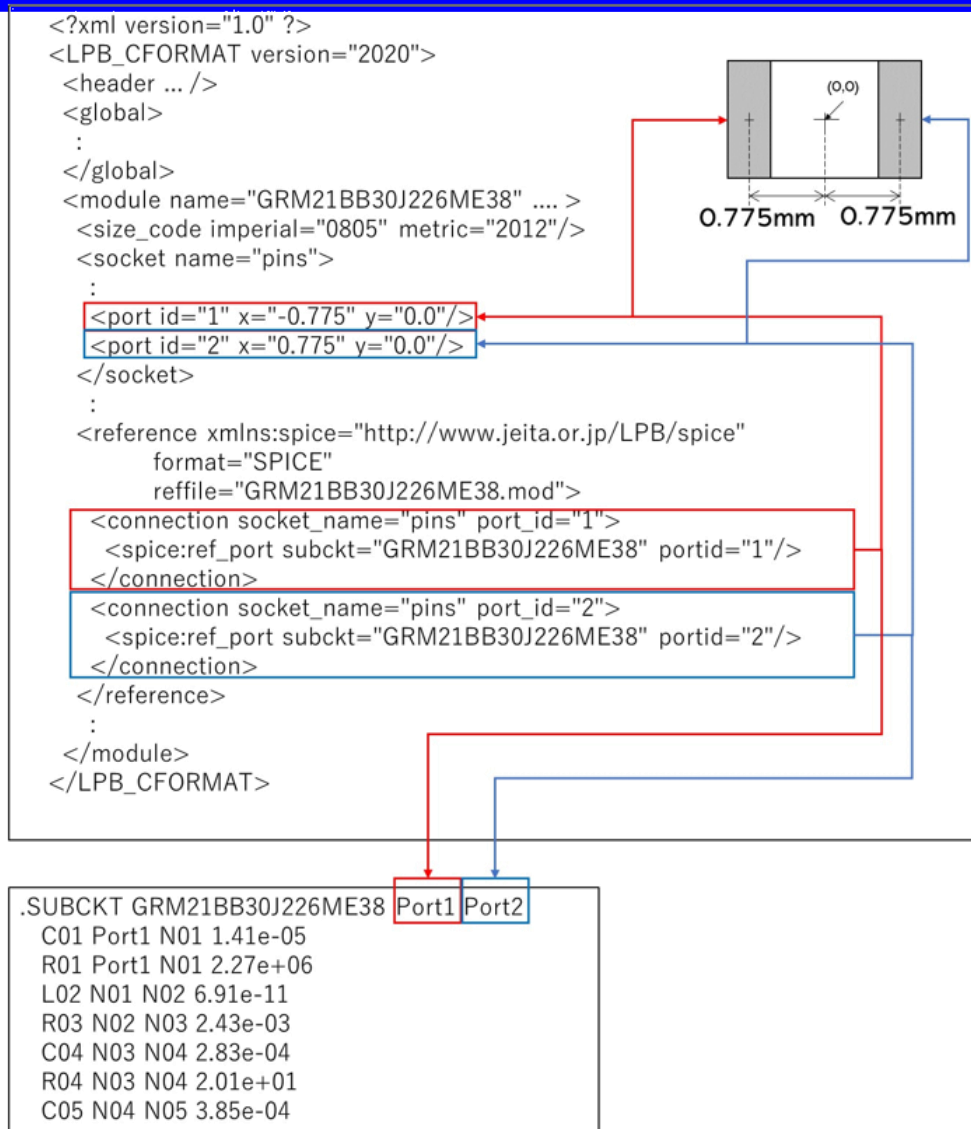


L size	2.0mm
W size	1.25mm
T size	1.25mm
External electrode size e	0.2~0.7mm
External electrode distance g	0.7mm
Size code	2012M

The following is an example of the GRM21BB30J226ME38 C format. In this C format, the footprint of the part and the SPICE model (S parameter) are linked. Below, we will look at the details of this C format.

```
<?xml version="1.0" ?>
<LPB_CFORMAT version="2020">
  <header design_revision="1.0" project="GRM"
    company="MURATA" date="Wednesday Dec. 19 2018"/>
  <global>
    <unit> <distance unit="mm"/> <capacitance unit="uF"/> </unit>
    <shape>
      <rectangle id="1" height="1.25" width="2"/>
      <rectangle id="2" height="1.25" width="0.45"/>
    </shape>
  </global>
</LPB_CFORMAT>
```

Sample of textbook



Conclusion

- IEEE-2401-2019 has been published as a new version of LPB format
- IEEE-2401-2019 can indicate “Interconnect Model” in IBIS Version 7.0
- JEITA LPB working group is preparing education course for IEEE-2401-2019 to accelerate utilization of this format

Thank you!